

# THE ASTROPHYSICAL JOURNAL

AN INTERNATIONAL REVIEW OF SPECTROSCOPY AND  
ASTRONOMICAL PHYSICS

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APRIL 1931

NOTES ON THE B AND C SPECTRAL SERIES, ZONE B -75° TO -40°

ON THE POSITION OF THE LINES IN THE B BAND OF THE SUN AND IN THE B SPECTRUM

NOTES ON SPOTPHOTOMETRY

UNIVERSITY OF CHICAGO  
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# THE ASTROPHYSICAL JOURNAL

AN INTERNATIONAL REVIEW OF SPECTROSCOPY AND  
ASTRONOMICAL PHYSICS

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## THE YERKES ACTINOMETRY, SECOND SERIES

ZONE  $+75^{\circ}$  TO  $+60^{\circ}$

BY ARTHUR S. FAIRLEY

### ABSTRACT

*The photographic magnitudes of 2354 stars were determined by means of extra-focal images and an absolute scale.*

*The zero point was determined from the stars from the Potsdam Photometric Durchmusterung on each plate.*

*Probable errors for 532 stars were found and classified in various ways.*

*Color indices were found from these magnitudes and those of the H.R.*

Professor J. A. Parkhurst in "The Yerkes Actinometry"<sup>1</sup> gave a catalogue of the stars of the *Potsdam Photometric Durchmusterung*<sup>2</sup> in the zone  $+90^{\circ}$  to  $+73^{\circ}$  declination, down to magnitude 7.5, for which he had determined the photographic and photovisual magnitudes and the spectral types. It seemed desirable to Professor E. B. Frost, director of the Yerkes Observatory, that this work be continued. Accordingly, he sought a grant for this purpose from the Rosenwald Fund of the University of Chicago, which was very kindly given. The writer came to the Yerkes Observatory in June, 1928, and in July of that year began the systematic photographing and reducing which has resulted in the accompanying catalogue. It was decided to lower the limit of brightness of the stars included to  $8^m 25$ , and to concentrate on photographic magnitudes. Therefore this catalogue contains the photographic magnitudes of stars down to  $8^m 25$ , and from  $+75^{\circ}$  to  $+60^{\circ}$  declination.

<sup>1</sup> *Astrophysical Journal*, **36**, 169, 1912.

<sup>2</sup> *Publicationen des Astrophysicalischen Observatoriums zu Potsdam*, **17**, 1907.

The instrument used is the Zeiss 14.5-cm doublet of 81-cm focal length made of UV glass, which is particularly transparent to the near ultra-violet. The useful field of the instrument is 6°.4. Plates were taken in the same manner in which Parkhurst took them, 6 mm inside the focus for photographic light, where the images are a little over a millimeter in diameter, and of a remarkably uniform density, as may be seen from Plate II. About 1000 plates were taken for this zone: 925 by the writer, 50 by R. G. Barton, and 25 by A. W. Recht. The plates used were Eastman 40's and the usual exposure time was twenty-five minutes. The plates were developed in Eastman D-11 developer for six minutes at 20° C. The fields were centered at +73°, +71°, +69°, +67°, +65°, +62°, and +59° declination, and every twenty minutes in right ascension. The average number of plates upon which each star appeared was 6. The plates were taken as nearly as possible at the altitude of the pole.

The plates were measured in the Hartmann microphotometer, one setting being made on each image. It was found that this instrument gave much more accurate results when both the plate and the wedge were enough out of focus in the same direction so that the grain of neither showed. At the beginning of the work more than one setting was made on each image, but when the observer acquired some skill it was found that the settings repeated themselves so uniformly that all but one were eliminated.

#### ZERO POINT AND SCALE

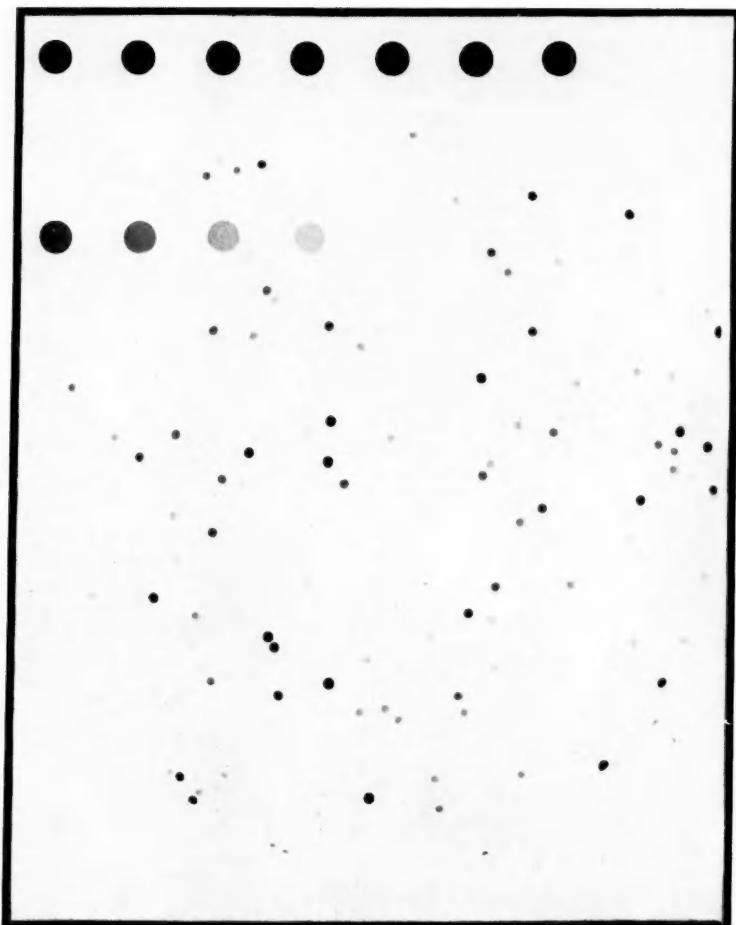
On each plate there were several stars from the *Potsdam Photometric Durchmusterung*, whose spectra, from the *Henry Draper Catalogue*, were between B<sub>5</sub> and A<sub>5</sub>. The Potsdam visual magnitudes of all such stars on a plate were corrected for color index to A<sub>0</sub> according to the following table derived from the work of E. S. King.<sup>1</sup>

| Sp.                  | Corr. | Sp.                  | Corr. |
|----------------------|-------|----------------------|-------|
| B <sub>5</sub> ..... | -0.20 | A <sub>0</sub> ..... | 0.00  |
| B <sub>8</sub> ..... | .07   | A <sub>2</sub> ..... | +.08  |
| B <sub>9</sub> ..... | -0.04 | A <sub>3</sub> ..... | .11   |
|                      |       | A <sub>5</sub> ..... | +.20  |

<sup>1</sup> *Harvard Annals*, 59, 157, 1912.



PLATE II



E X T R A - F O C A L P L A T E S H O W I N G S T A R I M A G E S A N D S E N S I T O M E T E R D I S K S

The three fainter sensitometer areas were lost in reproduction

The mean of these corrected magnitudes was then taken and a further correction of  $-0^m.28$  was applied to change from the zero point of the Potsdam scale to that of the international scale. The resulting magnitude gave the zero point for the plate in question. This calculation was made for each plate. The number of such so-called standard stars averaged 6.2 per plate, the maximum number being 22 and the minimum 1. These stars are designated by S in the column of "Remarks" of the catalogue.

After each plate was exposed in the telescope and before it was developed, it was exposed in a sensitometer which impressed on it areas of standard intensity. The sensitometer consists of a metal plate containing fourteen holes of accurately known size, the apertures decreasing in size progressively from one end to the other. This plate is illuminated by an electric lamp shining through several pieces of opal glass, so that the illumination is uniform over the whole area. Several inches from the first plate is another metal plate with fourteen holes of 4.5-mm diameter whose centers correspond with the centers of the holes in the first plate. Between the two plates are cells containing diaphragms which reduce internal reflections. The photographic plate is placed in contact with the metal plate having the uniform holes, and the light is turned on for a sufficient length of time to cause the formation of images of a suitable density for measuring. The relative density of each image will depend solely upon the area of the original hole, and as these areas are accurately known, the series of sensitometer images forms a completely independent scale except for local variations in the emulsion of the individual photographic plate (see Plate II).

#### REDUCTION OF PLATES

When the plates are measured in the Hartmann microphotometer, the sensitometer images are measured in exactly the same way as those of the stars. It is then possible to plot the scale readings against values of the relative magnitudes of the sensitometer images and to draw a smooth curve through the points. The relative magnitude of each star on the plate is then read from this curve by means of the microphotometer setting, and the zero point of the plate determined as explained above. Thus each plate by itself is an independent

determination, having its own scale and zero point without reference to any other plate. The wedge simply forms a link between the images of the stars and the sensitometer disks; thus its "constant" is entirely unimportant.

#### CORRECTIONS

1. *Correction to the center of the plate.*—A series of equal exposures of the same star at varying distances from the center of a plate was made, and from the differences in their opacity corrections to the center of the plate were found as follows:

| Distance from the Center in Degrees | Corr.              | Distance from the Center in Degrees | Corr.              |
|-------------------------------------|--------------------|-------------------------------------|--------------------|
| 0°.5.....                           | 0 <sup>M</sup> .01 | 2°.0.....                           | 0 <sup>M</sup> .14 |
| 1.0.....                            | .03                | 2.5.....                            | .22                |
| 1.5.....                            | 0.08               | 3.0.....                            | .30                |
|                                     |                    | 3.2.....                            | 0.34               |

Stars farther than 3°.2 from the center were not measured. These corrections were confirmed by the measures of stars appearing on more than one plate.

No correction for sky fog on the plates was found necessary, as the sensitometer images were superimposed on this fog in exactly the same manner as were the star images, so that both were equally affected. Local variations in density of the background, owing to non-uniformity of the emulsion of the plate, were usually found too small to be measured.

2. *Correction for atmospheric absorption.*—The only correction for atmospheric absorption necessary is a very small one to reduce each star to the center of the plate. For this the values of C. Wirz<sup>1</sup> were used. Since the magnitudes of the Potsdam stars used as standards are reduced to the zenith already, magnitudes derived from them will need no further correction for absorption.<sup>2</sup>

#### WEIGHTS IN FINAL CATALOGUE

The individual determinations of the magnitudes of each star were weighted according to the distance of the image from the center of the plate. This was done because of the progressive loss of uni-

<sup>1</sup> *Astronomische Nachrichten*, 154, 349, 1900.

<sup>2</sup> For Parkhurst's color corrections for this instrument see this *Journal*, 36, 181, 1912.

formity of the images at increasing distances from the center. The weights were assigned as follows:

| Distance from Center          | Weight | Distance from Center          | Weight |
|-------------------------------|--------|-------------------------------|--------|
| $0^{\circ}0-1^{\circ}5$ ..... | 6      | $2^{\circ}4-2^{\circ}7$ ..... | 3      |
| $1^{\circ}5-2^{\circ}0$ ..... | 5      | $2.7-3.0$ .....               | 2      |
| $2.0-2.4$ .....               | 4      | $3.0-3.2$ .....               | 1      |

The weighted mean of the individual determinations is the magnitude in the catalogue. No star is included in the catalogue unless it was measured on at least two plates.

#### ACCURACY OF RESULTS

The probable errors were determined for 532 stars chosen at random from the total number. The mean for all of them is  $\pm 0.033$ .

The number of plates on which each star appeared varied from 2 to 14, the average being 5.9. Probable errors classified according to the number of plates are as follows:

| No. of plates..... | 2    | 3    | 4    | 5    | 6    | 7    | 8    | 9    | 10   | 11   | 12   |
|--------------------|------|------|------|------|------|------|------|------|------|------|------|
| P.E. $\pm 0$ ..... | .049 | .039 | .038 | .036 | .034 | .021 | .021 | .018 | .019 | .014 | .016 |

Probable errors classified according to magnitude:

| Magnitude        | $> 5.0$ | $5.0-5.5$ | $5.5-6.0$ | $6.0-6.5$ | $6.5-7.0$ | $7.0-7.5$ | $7.5-8.0$ | $8.0-8.5$ | $8.5$ and<br>fainter |
|------------------|---------|-----------|-----------|-----------|-----------|-----------|-----------|-----------|----------------------|
| P.E. $\pm 0$ ... | .044    | .016      | .024      | .023      | .023      | .029      | .035      | .033      | .036                 |
| No. of stars     | 12      | 4         | 8         | 16        | 20        | 36        | 100       | 180       | 156                  |

Leaving out the groups brighter than 5.0 and fainter than 8.5 reduces the mean probable error to  $\pm 0.032$ , which is identical with that obtained by Parkhurst.

The spectrum of each star is taken from the *Henry Draper Catalogue*, and the probable errors classified according to spectral type are as follows:

| Spectral type..... | B    | A    | F    | G    | K    | M    |
|--------------------|------|------|------|------|------|------|
| P.E. $\pm 0$ ..... | .035 | .035 | .030 | .036 | .035 | .043 |

It is interesting to note the decided increase in probable error for the red stars. This may be due to the fact, found by J. Stebbins,<sup>1</sup> that there is a large number of irregular variables of small range among these stars.

By combining the photographic magnitudes of this catalogue with the visual magnitudes of the *H.R.* color indices may be found. Such color indices, of course, will combine the accidental and scale errors of both catalogues as well as the errors of spectral classification, and

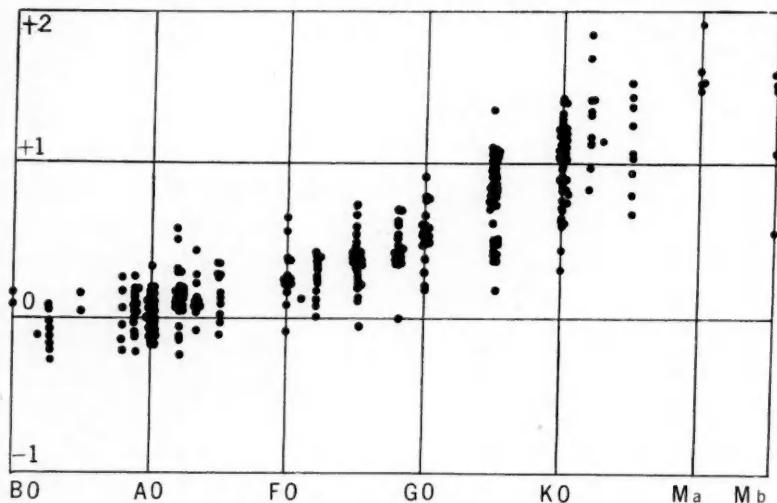


FIG. 1.—Color indices and spectral type

so would be expected to have a rather large scattering. The scattering actually found, however, is much larger than can be accounted for by this means, and leads to the conclusion, found recently by F. E. Ross and R. S. Zug,<sup>2</sup> that the relation between color index and spectral type is at best an approximate one.

The table on page 131 shows the mean color index, Yerkes—*H.R.*, for each spectral type.

Figure 1 shows the scattering which is found. The stars plotted are those from zero to three hours, and from twelve to fifteen hours of right ascension. The size of the circle representing each star is ap-

<sup>1</sup> *Publications of the Washburn Observatory*, 15, Part 3, 139, 1930.

<sup>2</sup> *Astronomische Nachrichten*, 239, 289, 1930.

proximately equal to the probable error of the photographic magnitude.

At this writing 8/10 of the plates necessary for the continuation of this work from  $+60^{\circ}$  to  $+45^{\circ}$  have been obtained, and the reductions are in progress.

|         | 0     | 2     | 3                   | 5     | 8     | 9     |
|---------|-------|-------|---------------------|-------|-------|-------|
| B.....  | +0.1  | -0.1  | -0.11               | -0.10 | -0.03 | -0.01 |
| A.....  | .00   | +.03  | +.06                | +.10  | ..... | ..... |
| F.....  | .20   | 0.23  | .....               | .32   | +.41  | ..... |
| G.....  | 0.50  | ..... | .....               | 0.75  | ..... | ..... |
| K.....  | 1.00  | +.10  | .....               | +.26  | ..... | ..... |
| Ma..... | +1.55 | ..... | { Mb }<br>{ +1.60 } | ..... | ..... | ..... |

I wish to thank Professor Edwin B. Frost for his kind assistance at all stages of this work. I am particularly indebted to my wife for much valuable assistance in computation and in preparing the tables.

YERKES OBSERVATORY

January 26, 1931

CATALOGUE OF ZONE  $+75^{\circ}$  TO  $+60^{\circ}$ 

| B.D. No.      | R.A. 1900                                    | Dec. 1900 | H.R. Mag. | H.D. Sp. | Ptg. Mag. | No. Pl. | Remarks |
|---------------|--|-----------|-----------|----------|-----------|---------|---------|
| 68° 1426..... | o <sup>h</sup> 0 <sup>m</sup> 1 <sup>s</sup> | 68° 19'   | 6.98      | B9       | 7.01      | 7       | S       |
| 62 2302.....  | o 0.9  | 63 07     | .....     | B9       | 7.29      | 3       |         |
| 65 2001.....  | o 1.7  | 65 52     | .....     | Fo       | 8.33      | 2       |         |
| 71 1250.....  | o 1.8  | 72 13     | .....     | A3       | 8.47      | 11      |         |
| 72 1140.....  | o 1.9  | 72 39     | .....     | F2       | 8.07      | 9       |         |
| 70 1.....     | o 2.8  | 70 36     | .....     | Ao       | 8.35      | 9       |         |
| 62 5.....     | o 3.3  | 62 39     | 6.59      | G5       | 7.36      | 6       |         |
| 73 2.....     | o 3.4  | 73 39     | 7.42      | Ao       | 7.39      | 9       | S       |
| 64 3.....     | o 3.9  | 64 32     | 7.02      | Ko       | 7.90      | 7       |         |
| 64 5.....     | o 4.7  | 65 11     | 7.95      | Ao       | 7.80      | 7       |         |
| 63 5.....     | o 4.9  | 64 05     | .....     | Ko       | 9.33      | 5       |         |
| 73 4.....     | o 5.9  | 73 56     | 7.10      | Ko       | 8.20      | 8       |         |
| 65 13.....    | o 6.5  | 65 34     | 7.15      | Ao       | 7.25      | 5       | S       |
| 67 5.....     | o 6.8  | 67 52     | .....     | A2       | 8.46      | 4       |         |
| 67 6.....     | o 7.8  | 67 37     | .....     | F5       | 8.50      | 6       |         |
| 61 16.....    | o 7.9  | 61 29     | 6.59      | Ao       | 6.59      | 5       | S       |
| 67 7.....     | o 8.2  | 67 30     | .....     | Fo       | 8.37      | 8       |         |
| 64 15.....    | o 8.4  | 64 18     | 7.92      | Go       | 8.11      | 7       |         |
| 65 21.....    | o 8.9  | 65 47     | .....     | A3       | 8.00      | 4       |         |
| 59 16.....    | o 8.9  | 60 10     | 7.76      | Ao       | 8.08      | 5       |         |
| 63 15.....    | o 9.4  | 64 00     | .....     | A2       | 8.10      | 6       |         |
| 60 16.....    | o 10.6                                       | 60 27     | 6.62      | G5       | 7.13      | 5       |         |
| 62 38.....    | o 11.6                                       | 63 00     | .....     | Ao       | 7.63      | 5       |         |
| 60 21.....    | o 11.6                                       | 60 59     | 5.80      | G5       | 6.51      | 6       |         |
| 75 6.....     | o 11.8                                       | 75 35     | 8.57      | Ao       | 8.81      | 4       |         |
| 62 40.....    | o 12.0                                       | 62 16     | .....     | Ao       | 8.10      | 5       | Var.?   |
| 72 15.....    | o 12.6                                       | 72 24     | 7.50      | A3       | 7.66      | 10      | S       |
| 75 7.....     | o 12.8                                       | 75 43     | 7.12      | B9       | 7.20      | 4       | S       |
| 60 25.....    | o 12.9                                       | 61 10     | .....     | Bo       | 7.52      | 6       |         |
| 61 32.....    | o 13.1                                       | 61 39     | 7.13      | K5       | 8.23      | 6       |         |
| 66 15.....    | o 13.2                                       | 66 45     | 7.93      | Ao       | 7.83      | 8       | S       |
| 62 48.....    | o 13.5                                       | 62 44     | 7.58      | Fo       | 7.67      | 5       |         |
| 72 17.....    | o 13.7                                       | 72 34     | 7.34      | Ko       | 8.37      | 9       |         |
| 61 38.....    | o 14.6                                       | 61 31     | .....     | B2       | 7.78      | 6       |         |
| 68 14.....    | o 14.8                                       | 68 18     | 7.64      | F2       | 7.78      | 8       |         |
| 66 19.....    | o 15.4                                       | 67 07     | .....     | G5       | 8.37      | 7       |         |
| 62 58.....    | o 15.4                                       | 63 07     | .....     | Go       | 8.58      | 2       |         |
| 67 27.....    | o 16.2                                       | 67 16     | 6.74      | Ko       | 7.49      | 9       |         |
| 60 37.....    | o 16.2                                       | 61 8      | .....     | F8       | 7.42      | 6       |         |
| 70 10.....    | o 16.3                                       | 70 41     | .....     | A2       | 8.45      | 10      |         |
| 74 8.....     | o 16.6                                       | 74 31     | .....     | A5       | 8.94      | 5       |         |
| 70 12.....    | o 16.6                                       | 70 57     | 7.78      | K2       | 9.30      | 3       |         |
| 61 48.....    | o 16.6                                       | 61 38     | .....     | B3       | 7.91      | 5       |         |
| 61 50.....    | o 17.4                                       | 61 41     | .....     | B3       | 7.69      | 5       |         |
| 64 36.....    | o 17.8                                       | 64 48     | 7.39      | Fo       | 8.07      | 7       |         |

CATALOGUE—*Continued*

| B.D. No.    | R.A. 1900                        | Dec. 1900 | H.R. Mag. | H.D. Sp. | Ptg. Mag. | No. Pl. | Remarks |
|-------------|----------------------------------|-----------|-----------|----------|-----------|---------|---------|
| 65° 48..... | o <sup>h</sup> 18 <sup>m</sup> 1 | 65° 39'   | 8.40      | F0       | 8.31      | 5       |         |
| 60 45.....  | o 18.4                           | 60 23     | 6.75      | F2       | 6.75      | 7       |         |
| 63 38.....  | o 18.6                           | 63 45     | .....     | B9       | 8.31      | 4       |         |
| 61 69.....  | o 19.3                           | 61 17     | 5.39      | B9       | 5.43      | 5       |         |
| 71 16.....  | o 20.1                           | 71 15     | 6.94      | B2       | 6.82      | 11      |         |
| 64 44.....  | o 20.3                           | 64 50     | 7.55      | B0       | 7.44      | 10      | S       |
| 63 52.....  | o 23.6                           | 63 42     | .....     | Ao       | 8.24      | 5       |         |
| 74 14.....  | o 23.9                           | 74 41     | .....     | Ko       | 9.05      | 5       |         |
| 61 94.....  | o 24.0                           | 61 31     | .....     | Ko       | 7.83      | 5       |         |
| 68 25.....  | o 24.1                           | 68 32     | .....     | A2       | 7.46      | 2       |         |
| 71 19.....  | o 24.4                           | 72 00     | .....     | Ao       | 9.24      | 4       | S       |
| 63 53.....  | o 24.6                           | 64 12     | 7.16      | Ao       | 7.08      | 8       |         |
| 64 52.....  | o 24.7                           | 64 43     | .....     | B        | 8.30      | 9       |         |
| 61 101..... | o 25.1                           | 61 48     | 7.31      | B3       | 7.00      | 5       |         |
| 68 29.....  | o 25.2                           | 69 14     | 7.41      | F8       | 7.72      | 10      |         |
| 63 55.....  | o 25.2                           | 63 31     | .....     | F8       | 8.13      | 5       | S       |
| 65 67.....  | o 25.7                           | 65 58     | 6.14      | B5       | 6.18      | 8       |         |
| 67 50.....  | o 26.2                           | 67 27     | .....     | F0       | 8.06      | 10      |         |
| 66 35.....  | o 26.3                           | 66 36     | .....     | B8       | 8.13      | 9       |         |
| 70 24.....  | o 27.4                           | 70 25     | 6.36      | Ao       | 6.55      | 10      | S       |
| 74 20.....  | o 27.7                           | 74 56     | .....     | Ao       | 8.55      | 4       |         |
| 59 76.....  | o 27.9                           | 60 00     | 7.66      | B9       | 7.56      | 4       |         |
| 65 70.....  | o 28.6                           | 66 12     | 6.42      | B9       | 6.41      | 10      | S       |
| 66 39.....  | o 28.8                           | 66 57     | 7.31      | A3       | 7.39      | 10      | S       |
| 62 107..... | o 28.8                           | 62 22     | 7.51      | F5       | 7.70      | 3       |         |
| 68 35.....  | o 29.4                           | 60 12     | .....     | B9       | 8.42      | 4       |         |
| 74 22.....  | o 30.2                           | 74 59     | .....     | G5       | 9.04      | 4       |         |
| 68 38.....  | o 30.6                           | 68 44     | .....     | Go       | 8.41      | 8       |         |
| 62 116..... | o 30.6                           | 62 40     | .....     | Ao       | 8.03      | 3       |         |
| 69 29.....  | o 30.7                           | 70 01     | 8.26      | F8       | 8.25      | 7       |         |
| 67 57.....  | o 30.8                           | 68 08     | .....     | F0       | 8.37      | 8       |         |
| 72 35.....  | o 31.6                           | 72 21     | 7.06      | B3       | 6.96      | 9       |         |
| 62 130..... | o 34.1                           | 62 41     | 7.70      | F5       | 7.90      | 5       |         |
| 69 32.....  | o 34.3                           | 70 10     | 7.17      | Ao       | 7.23      | 10      | S       |
| 65 81.....  | o 35.6                           | 65 19     | 7.10      | F8       | 7.34      | 8       |         |
| 66 53.....  | o 35.7                           | 67 14     | .....     | F0       | 8.38      | 6       |         |
| 65 83.....  | o 36.1                           | 65 36     | 5.92      | G5       | 6.95      | 8       |         |
| 73 30.....  | o 36.4                           | 73 31     | .....     | B9       | 8.19      | 7       |         |
| 63 81.....  | o 36.9                           | 63 45     | 7.40      | B5       | 7.58      | 5       |         |
| 61 152..... | o 37.0                           | 62 13     | .....     | Ao       | 7.61      | 5       |         |
| 70 43.....  | o 37.8                           | 70 17     | 6.49      | Ko       | 7.64      | 8       |         |
| 66 55.....  | o 38.4                           | 66 28     | .....     | F8       | 8.26      | 8       |         |
| 64 75.....  | o 38.5                           | 64 46     | .....     | Ao       | 8.05      | 10      |         |
| 66 58.....  | o 38.7                           | 66 37     | 6.85      | F8       | 7.16      | 8       |         |
| 74 27.....  | o 39.2                           | 74 26     | 5.59      | A2       | 6.14      | 5       | S       |

CATALOGUE—*Continued*

| B.D. No.     | R.A. 1900                                     | Dec. 1900 | H.R. Mag. | H.D. Sp. | Ptg. Mag. | No. Pl. | Remarks |
|--------------|---|-----------|-----------|----------|-----------|---------|---------|
| 61° 165..... | o <sup>h</sup> 39 <sup>m</sup> 2 <sup>s</sup> | 61° 59'   | 6.84      | Ko       | 7.99      | 5       |         |
| 65 88.....   | o 39.8  | 65 57     | .....     | Go       | 7.73      | 7       |         |
| 68 49.....   | o 40.3  | 68 47     | 6.42      | F2       | 6.81      | 8       |         |
| 72 38.....   | o 40.5  | 72 33     | .....     | Ko       | 8.85      | 5       |         |
| 75 42.....   | o 41.1  | 76 00     | 8.47      | Ao       | 8.48      | 3       |         |
| 74 29.....   | o 41.1  | 74 18     | 5.39      | B8       | 5.67      | 5       |         |
| 71 37.....   | o 41.6  | 72 08     | 6.04      | Ko       | 7.08      | 10      |         |
| 64 82.....   | o 42.2  | 64 34     | 7.06      | G5       | 7.68      | 7       |         |
| 67 41.....   | o 43.0  | 67 55     | .....     | B8       | 7.99      | 9       |         |
| 69 45.....   | o 43.2  | 69 54     | 7.99      | Ko       | 8.30      | 8       |         |
| 72 42.....   | o 43.4  | 73 02     | .....     | Ao       | 8.83      | 4       |         |
| 71 41.....   | o 43.6  | 71 21     | 7.01      | B9       | 6.77      | 8       |         |
| 70 53.....   | o 43.7  | 70 38     | 7.39      | B9       | 7.45      | 9       |         |
| 64 84.....   | o 43.7  | 64 33     | .....     | A5       | 7.93      | 7       |         |
| 62 153.....  | o 43.8  | 62 16     | .....     | A5       | 8.12      | 6       |         |
| 63 101.....  | o 45.1  | 63 47     | .....     | A2       | 8.08      | 6       |         |
| 68 56.....   | o 45.3  | 68 26     | .....     | A2       | 7.83      | 8       |         |
| 61 178.....  | o 45.3  | 61 16     | 6.36      | K2       | 8.09      | 4       |         |
| 62 160.....  | o 45.4  | 63 14     | 7.06      | B3       | 7.11      | 6       |         |
| 70 57.....   | o 45.8  | 71 06     | 8.00      | G5       | 8.82      | 4       |         |
| 68 57.....   | o 46.4  | 68 20     | 7.12      | A2       | 7.25      | 8       |         |
| 65 103.....  | o 46.4  | 65 21     | 8.33      | A2       | 8.02      | 8       |         |
| 73 40.....   | o 46.5  | 73 46     | 7.56      | A5       | 7.82      | 7       |         |
| 69 50.....   | o 46.9  | 69 25     | 7.36      | Mb       | 8.39      | 2       |         |
| 63 105.....  | o 46.9  | 63 25     | 7.36      | Mb       | 7.87      | 6       |         |
| 60 124.....  | o 47.1  | 60 34     | 4.93      | F8       | 5.62      | 4       |         |
| 71 41.....   | o 47.3  | 71 21     | .....     | Ao       | 9.00      | 4       |         |
| 59 134.....  | o 47.5  | 60 08     | 7.81      | A2       | 7.60      | 4       |         |
| 65 106.....  | o 47.9  | 65 54     | 7.06      | Fo       | 7.24      | 8       |         |
| 60 130.....  | o 49.0  | 60 08     | .....     | B9       | 8.16      | 4       |         |
| 63 112.....  | o 49.1  | 64 01     | 7.54      | A3       | 7.57      | 5       |         |
| 65 110.....  | o 50.0  | 65 53     | .....     | Ao       | 7.86      | 8       |         |
| 63 114.....  | o 50.0  | 63 18     | .....     | Ko       | 8.62      | 3       |         |
| 69 54.....   | o 50.1  | 69 55     | .....     | A2       | 8.30      | 7       |         |
| 60 135.....  | o 50.2  | 60 43     | 7.96      | Ao       | 7.87      | 4       |         |
| 67 81.....   | o 50.4  | 68 15     | 6.38      | Fo       | 6.75      | 7       |         |
| 74 40.....   | o 50.5  | 74 45     | .....     | F        | 9.00      | 4       |         |
| 75 45.....   | o 50.7  | 75 28     | 8.72      | A2       | 8.95      | 4       |         |
| 63 117.....  | o 50.7  | 64 00     | 7.23      | F2       | 7.82      | 7       |         |
| 74 41.....   | o 50.8  | 74 57     | .....     | Ao       | 7.65      | 4       |         |
| 70 61.....   | o 51.1  | 70 53     | .....     | F5       | 9.02      | 3       |         |
| 60 137.....  | o 51.2  | 60 53     | 6.62      | G5       | 7.40      | 4       |         |
| 69 55.....   | o 51.6  | 69 57     | 6.86      | B9       | 6.81      | 9       |         |
| 64 107.....  | o 51.6  | 64 51     | .....     | Ao       | 8.15      | 10      |         |
| 63 118.....  | o 52.1  | 63 35     | .....     | Ao       | 8.58      | 6       |         |

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|--------------|----------------------------------|-----------|-----------|----------|-----------|---------|---------|
| 65° 115..... | 0 <sup>h</sup> 52 <sup>m</sup> 2 | 65° 49'   | 6.00      | B9       | 6.00      | 6       | S       |
| 62 175.....  | 0 52.2                           | 63 11     | .....     | B2       | 7.93      | 6       |         |
| 66 79.....   | 0 52.3                           | 66 55     | .....     | F2       | 8.29      | 11      |         |
| 72 53.....   | 0 52.6                           | 72 16     | .....     | A2       | 8.97      | 4       |         |
| 68 63.....   | 0 53.7                           | 68 49     | .....     | Ao       | 8.19      | 6       |         |
| 70 65.....   | 0 53.8                           | 70 26     | 6.46      | Ao       | 6.61      | 10      | S       |
| 72 55.....   | 0 54.1                           | 73 00     | .....     | A3       | 8.70      | 5       |         |
| 64 100.....  | 0 54.3                           | 64 37     | .....     | B9       | 8.14      | 10      |         |
| 62 181.....  | 0 54.3                           | 62 30     | .....     | B8       | 8.20      | 5       |         |
| 69 61.....   | 0 54.9                           | 70 00     | 7.84      | F5       | 7.92      | 8       |         |
| 68 64.....   | 0 54.9                           | 68 49     | 6.67      | B9       | 6.65      | 8       | S       |
| 65 120.....  | 0 55.0                           | 65 20     | 8.20      | G5       | 8.36      | 5       |         |
| 65 123.....  | 0 55.3                           | 65 42     | .....     | Go       | 8.51      | 3       |         |
| 62 185.....  | 0 55.6                           | 63 04     | .....     | Fo       | 8.21      | 6       |         |
| 70 70.....   | 0 56.0                           | 70 30     | .....     | Ao       | 8.10      | 10      |         |
| 68 67.....   | 0 56.2                           | 68 42     | .....     | G5       | 8.16      | 6       |         |
| 73 50.....   | 0 56.3                           | 73 38     | .....     | F5       | 8.62      | 5       |         |
| 69 63.....   | 0 56.4                           | 69 47     | 7.97      | Ao       | 7.93      | 8       |         |
| 61 196.....  | 0 56.5                           | 62 05     | .....     | Ko       | 8.21      | 5       |         |
| 72 58.....   | 0 56.7                           | 72 20     | .....     | A2       | 8.96      | 4       |         |
| 64 116.....  | 0 56.7                           | 64 18     | .....     | F8       | 8.39      | 6       |         |
| 70 72.....   | 0 57.0                           | 70 53     | .....     | F5       | 9.22      | 3       |         |
| 62 191.....  | 0 57.4                           | 63 09     | .....     | Go       | 8.23      | 6       |         |
| 60 157.....  | 0 57.4                           | 60 32     | 5.94      | Fo       | 6.52      | 6       |         |
| 73 51.....   | 0 57.6                           | 73 50     | 6.78      | Ao       | 6.99      | 8       | S       |
| 68 70.....   | 0 58.6                           | 68 27     | .....     | Ao       | 8.14      | 5       |         |
| 62 194.....  | 0 59.0                           | 63 12     | .....     | Go       | 8.36      | 6       |         |
| 70 73.....   | 0 59.3                           | 70 40     | .....     | Ao       | 9.19      | 3       |         |
| 65 120.....  | 0 59.4                           | 65 26     | 7.10      | B8       | 7.22      | 8       | S       |
| 62 195.....  | 0 59.4                           | 62 20     | .....     | Fo       | 8.14      | 7       |         |
| 60 162.....  | 0 59.7                           | 60 15     | 8.21      | Ao       | 8.29      | 5       |         |
| 65 130.....  | 1 0.0                            | 65 55     | .....     | Ao       | 8.35      | 6       |         |
| 61 200.....  | 1 0.0                            | 62 14     | 6.44      | A3       | 6.52      | 5       | S       |
| 70 78.....   | 1 0.2                            | 70 24     | 6.64      | A2       | 6.79      | 9       | S       |
| 68 72.....   | 1 0.2                            | 68 18     | .....     | Ao       | 8.40      | 6       |         |
| 63 139.....  | 1 0.3                            | 63 54     | .....     | Go       | 7.78      | 6       |         |
| 62 203.....  | 1 1.2                            | 63 10     | .....     | G5       | 8.41      | 4       |         |
| 69 70.....   | 1 1.8                            | 70 10     | 7.54      | Ao       | 7.37      | 9       |         |
| 62 200.....  | 1 2.3                            | 63 10     | .....     | Go       | 8.29      | 5       |         |
| 68 74.....   | 1 2.4                            | 69 10     | .....     | Bo       | 7.00      | 8       |         |
| 60 170.....  | 1 3.2                            | 61 01     | .....     | Go       | 8.35      | 5       |         |
| 63 140.....  | 1 3.8                            | 64 07     | .....     | Ao       | 7.97      | 5       |         |
| 68 77.....   | 1 3.9                            | 68 15     | 5.34      | Ao       | 5.54      | 5       | S       |
| 61 218.....  | 1 3.9                            | 61 17     | .....     | B9       | 8.25      | 5       |         |
| 67 98.....   | 1 4.0                            | 67 15     | 6.65      | Go       | 7.07      | 8       |         |

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| 63° 147..... | 1 <sup>h</sup> 4 <sup>m</sup> 0 | 63° 39'   | .....        | A3          | 7.38         | 4       |         |
| 63 149.....  | 1 5.0                           | 63 40     | 5.46         | B9          | 5.62         | 4       | S       |
| 64 127.....  | 1 5.1                           | 64 29     | 5.49         | B8          | 5.67         | 5       | Var.?   |
| 73 59.....   | 1 6.1                           | 73 23     | 7.72         | Go          | 8.39         | 6       |         |
| 63 156.....  | 1 6.1                           | 64 05     | .....        | Ao          | 7.76         | 5       |         |
| 64 129.....  | 1 6.2                           | 64 28     | 7.46         | Fo          | 7.62         | 6       |         |
| 61 223.....  | 1 6.2                           | 61 21     | .....        | B           | 8.49         | 4       |         |
| 62 224.....  | 1 6.8                           | 62 18     | .....        | Ko          | 8.32         | 3       |         |
| 60 186.....  | 1 6.8                           | 61 10     | 6.29         | B9          | 6.46         | 4       | S       |
| 71 59.....   | 1 7.0                           | 71 58     | 8.62         | Ao          | 8.57         | 8       |         |
| 60 188.....  | 1 7.7                           | 60 21     | 7.26         | B3          | 7.06         | 4       |         |
| 70 87.....   | 1 7.8                           | 70 33     | 7.89         | Ko          | 8.51         | 7       |         |
| 68 83.....   | 1 8.3                           | 69 05     | .....        | Ao          | 8.37         | 5       |         |
| 61 229.....  | 1 8.4                           | 62 10     | .....        | Ao          | 8.25         | 3       |         |
| 60 193.....  | 1 8.4                           | 60 24     | 7.46         | F5          | 7.78         | 4       |         |
| 70 88.....   | 1 8.7                           | 70 34     | .....        | Ao          | 8.27         | 8       |         |
| 60 194.....  | 1 8.8                           | 60 20     | 8.66         | A           | 8.68         | 4       |         |
| 70 90.....   | 1 9.0                           | 71 13     | 6.38         | Ko          | 7.95         | 11      |         |
| 63 164.....  | 1 9.2                           | 63 47     | .....        | Ao          | 8.61         | 5       |         |
| 65 145.....  | 1 9.5                           | 65 36     | .....        | F5          | 8.50         | 4       |         |
| 61 233.....  | 1 9.6                           | 61 22     | 7.36         | F5          | 7.61         | 4       |         |
| 72 67.....   | 1 11.0                          | 72 52     | .....        | Ao          | 8.08         | 8       |         |
| 72 68.....   | 1 11.3                          | 72 21     | 7.18         | G5          | 8.15         | 8       |         |
| 71 64.....   | 1 11.4                          | 71 52     | 7.08         | G5          | 8.18         | 10      |         |
| 67 108.....  | 1 11.5                          | 67 17     | 6.70         | Ao          | 6.74         | 8       | S       |
| 62 235.....  | 1 11.8                          | 63 00     | .....        | Ao          | 8.33         | 3       |         |
| 65 151.....  | 1 12.2                          | 65 37     | .....        | Ao          | 8.39         | 5       |         |
| 71 67.....   | 1 12.3                          | 72 13     | 8.44         | F5          | 8.64         | 4       |         |
| 66 105.....  | 1 13.0                          | 66 42     | .....        | A3          | 8.45         | 7       |         |
| 73 66.....   | 1 13.8                          | 74 03     | 7.22         | A2          | 7.55         | 8       | S       |
| 68 93.....   | 1 14.1                          | 68 29     | .....        | Ao          | 8.43         | 5       |         |
| 60 209.....  | 1 14.4                          | 60 25     | 7.66         | Ao          | 7.52         | 4       | S       |
| 67 116.....  | 1 15.7                          | 68 02     | .....        | Fo          | 8.00         | 4       |         |
| 72 69.....   | 1 16.6                          | 72 20     | .....        | G5          | 7.64         | 9       |         |
| 60 221.....  | 1 16.8                          | 61 12     | .....        | Ao          | 8.37         | 3       |         |
| 73 71.....   | 1 17.6                          | 73 36     | .....        | Ao          | 7.95         | 7       |         |
| 70 102.....  | 1 18.4                          | 70 28     | 6.52         | Ao          | 6.46         | 9       | S       |
| 69 96.....   | 1 19.4                          | 69 52     | .....        | Go          | 8.35         | 4       |         |
| 66 115.....  | 1 19.9                          | 67 14     | .....        | F5          | 8.59         | 4       |         |
| 63 186.....  | 1 20.4                          | 64 11     | .....        | A3          | 8.23         | 5       |         |
| 73 75.....   | 1 21.0                          | 73 41     | 7.32         | G5          | 7.83         | 8       |         |
| 70 105.....  | 1 21.9                          | 70 24     | 8.39         | A5          | 8.40         | 6       |         |
| 64 168.....  | 1 22.9                          | 64 39     | 6.94         | K2          | 8.07         | 5       |         |
| 70 107.....  | 1 23.1                          | 71 12     | .....        | A2          | 9.05         | 2       |         |
| 72 75.....   | 1 23.2                          | 72 22     | 8.15         | Ko          | 9.35         | 2       |         |

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| 70° 108..... | 1 <sup>h</sup> 23 <sup>m</sup> 5 | 70° 36'   | .....     | Ko       | 9.50      | 2       |               |
| 63 193.....  | 1 23.5                           | 63 21     | .....     | Ao       | 7.96      | 3       |               |
| 69 100.....  | 1 23.6                           | 70 04     | 8.79      | Ao       | 8.51      | 2       |               |
| 69 102.....  | 1 23.8                           | 69 75     | 5.95      | F5       | 6.37      | 6       |               |
| 65 175.....  | 1 23.9                           | 65 35     | 6.16      | Ao       | 6.38      | 5       | S             |
| 61 281.....  | 1 24.1                           | 61 24     | .....     | B8       | 8.10      | 3       |               |
| 72 76.....   | 1 24.5                           | 72 24     | 8.34      | Go       | 8.87      | 2       |               |
| 62 259.....  | 1 24.6                           | 62 51     | 7.46      | Bop      | 7.77      | 3       | P.D.M. = 7.60 |
| 60 253.....  | 1 24.9                           | 61 02     | 7.56      | Ao       | 7.75      | 3       | S             |
| 60 255.....  | 1 25.0                           | 60 32     | 7.96      | B9       | 7.94      | 3       |               |
| 73 78.....   | 1 25.2                           | 64 06     | .....     | Ao       | 8.65      | 3       |               |
| 69 103.....  | 1 25.2                           | 69 30     | 6.93      | B9       | 6.80      | 7       |               |
| 67 133.....  | 1 25.2                           | 67 53     | 6.97      | Ko       | 7.93      | 6       |               |
| 67 134.....  | 1 25.4                           | 67 27     | .....     | B9       | 7.92      | 6       |               |
| 66 123.....  | 1 25.5                           | 66 44     | .....     | A3       | 8.54      | 3       |               |
| 62 263.....  | 1 25.5                           | 63 05     | 7.71      | Ao       | 7.85      | 3       |               |
| 70 112.....  | 1 25.7                           | 71 02     | .....     | F8       | 8.62      | 5       |               |
| 59 271.....  | 1 26.6                           | 60 10     | 7.26      | B3       | 7.11      | 3       |               |
| 61 289.....  | 1 26.8                           | 62 01     | .....     | K2       | 8.10      | 3       |               |
| 67 135.....  | 1 26.9                           | 68 10     | .....     | Ko       | 8.53      | 4       |               |
| 67 137.....  | 1 27.1                           | 67 57     | .....     | Fo       | 8.20      | 7       |               |
| 61 291.....  | 1 27.2                           | 61 38     | .....     | Ao       | 8.04      | 3       |               |
| 68 113.....  | 1 27.4                           | 68 26     | 6.66      | G5       | 7.13      | 7       |               |
| 71 87.....   | 1 27.8                           | 71 54     | .....     | G5       | 7.54      | 9       |               |
| 62 274.....  | 1 28.6                           | 62 34     | 6.79      | Ko       | 7.71      | 3       |               |
| 63 206.....  | 1 28.8                           | 63 38     | .....     | A2       | 8.38      | 3       |               |
| 71 89.....   | 1 28.9                           | 71 27     | .....     | F8       | 9.23      | 2       |               |
| 65 182.....  | 1 29.1                           | 65 43     | 8.30      | B9       | 8.23      | 4       |               |
| 73 81.....   | 1 29.2                           | 73 47     | 6.42      | B8       | 6.70      | 7       | S             |
| 66 134.....  | 1 29.2                           | 67 06     | 7.02      | Ao       | 7.11      | 8       | S             |
| 64 196.....  | 1 29.4                           | 64 46     | .....     | A2       | 8.52      | 2       |               |
| 62 277.....  | 1 29.9                           | 62 53     | 7.56      | Ao       | 7.57      | 3       | S             |
| 72 86.....   | 1 30.5                           | 72 32     | 5.50      | Ko       | 6.49      | 8       |               |
| 71 91.....   | 1 30.5                           | 72 04     | .....     | G5       | 9.14      | 2       |               |
| 64 202.....  | 1 30.8                           | 64 14     | 6.68      | F5p      | 7.38      | 5       |               |
| 73 84.....   | 1 31.0                           | 74 02     | 7.80      | Ao       | 8.13      | 5       |               |
| 64 203.....  | 1 31.0                           | 65 02     | .....     | Ko       | 8.20      | 4       |               |
| 61 304.....  | 1 31.4                           | 61 51     | 6.61      | B8       | 6.71      | 4       | S             |
| 74 73.....   | 1 31.7                           | 75 03     | .....     | Fo       | 9.34      | 2       |               |
| 60 296.....  | 1 32.4                           | 60 34     | 7.11      | Go       | 7.77      | 4       |               |
| 71 93.....   | 1 33.5                           | 71 44     | .....     | Ao       | 8.99      | 2       |               |
| 63 218.....  | 1 33.9                           | 63 40     | .....     | B        | 8.18      | 5       |               |
| 66 145.....  | 1 34.1                           | 66 25     | 7.60      | G5       | 8.14      | 6       |               |
| 65 193.....  | 1 34.2                           | 65 58     | 8.16      | A3       | 8.24      | 5       |               |
| 68 122.....  | 1 34.6                           | 68 34     | .....     | F5       | 7.81      | 7       |               |

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| 67° 149..... | 1 <sup>h</sup> 34 <sup>m</sup> 9 <sup>s</sup> | 67° 32'   | 5.54      | AoP      | 5.77      | 8       | S               |
| 66 149.....  | 1 34.9  | 66 17     | 7.06      | Ko       | 7.89      | 5       |                 |
| 60 305.....  | 1 34.9  | 60 35     | .....     | B9       | 8.37      | 3       |                 |
| 69 113.....  | 1 35.0  | 69 40     | .....     | F8       | 8.12      | 7       |                 |
| 69 114.....  | 1 35.2  | 70 07     | 5.26      | Ao       | 5.36      | 7       |                 |
| 73 92.....   | 1 35.3  | 74 06     | 6.79      | G5       | 7.70      | 5       |                 |
| 60 308.....  | 1 35.3  | 60 32     | 6.63      | B8       | 6.46      | 4       | S               |
| 59 306.....  | 1 35.9  | 60 03     | 7.36      | K2       | 8.15      | 3       |                 |
| 60 312.....  | 1 36.1  | 60 55     | 6.46      | B8       | 6.24      | 4       | S               |
| 70 124.....  | 1 36.4  | 70 24     | .....     | Ao       | 8.42      | 3       |                 |
| 59 307.....  | 1 36.6  | 60 03     | 5.75      | B9       | 5.73      | 3       | S               |
| 66 152.....  | 1 36.8  | 67 04     | .....     | G5       | 8.47      | 3       |                 |
| 74 78.....   | 1 37.5  | 74 19     | .....     | F5       | 8.47      | 5       |                 |
| 68 125.....  | 1 37.5  | 69 00     | 7.28      | G5       | 8.12      | 8       |                 |
| 63 230.....  | 1 37.7  | 63 50     | .....     | A2       | 8.43      | 4       |                 |
| 71 104.....  | 1 38.3  | 71 45     | .....     | Go       | 8.95      | 5       |                 |
| 67 157.....  | 1 40.0  | 67 15     | .....     | F8       | 8.43      | 4       |                 |
| 66 156.....  | 1 40.6  | 66 43     | .....     | Fo       | 8.32      | 6       |                 |
| 62 306.....  | 1 40.8  | 63 05     | .....     | A3       | 8.26      | 5       |                 |
| 70 133.....  | 1 40.9  | 71 05     | .....     | Ao       | 8.00      | 4       |                 |
| 66 161.....  | 1 42.2  | 67 11     | .....     | F5       | 8.29      | 6       |                 |
| 74 84.....   | 1 42.8  | 75 06     | 6.92      | F5       | 7.53      | 4       |                 |
| 67 164.....  | 1 44.0  | 67 52     | .....     | A5       | 7.71      | 7       |                 |
| 70 137.....  | 1 44.2  | 70 15     | 7.74      | F8       | 8.05      | 10      |                 |
| 67 165.....  | 1 45.5  | 67 42     | .....     | A2       | 8.18      | 6       |                 |
| 75 76.....   | 1 46.2  | 75 44     | 7.02      | A5       | 7.39      | 4       | S               |
| 68 134.....  | 1 46.5  | 68 42     | .....     | Ma       | 8.50      | 2       |                 |
| 75 77.....   | 1 46.6  | 75 32     | 8.37      | F5       | 8.54      | 2       |                 |
| 67 168.....  | 1 46.7  | 67 40     | 7.50      | Ao       | 7.17      | 7       | S               |
| 62 322.....  | 1 48.3  | 63 10     | .....     | A2       | 8.21      | 3       |                 |
| 74 87.....   | 1 48.7  | 74 51     | 6.70      | G5       | 7.71      | 4       |                 |
| 61 352.....  | 1 48.8  | 61 53     | .....     | Ao       | 7.61      | 2       |                 |
| 71 111.....  | 1 48.9  | 71 14     | 7.14      | A2       | 7.24      | 10      | S               |
| 60 383.....  | 1 49.4  | 60 47     | 7.34      | Ao       | 7.54      | 2       | S               |
| 70 146.....  | 1 49.8  | 70 21     | 8.74      | Ao       | 8.25      | 3       |                 |
| 64 268.....  | 1 50.2  | 64 55     | 7.95      | B3       | 7.99      | 4       |                 |
| 72 112.....  | 1 50.3  | 72 40     | 7.10      | G5       | 8.18      | 10      |                 |
| 73 104.....  | 1 50.8  | 73 29     | .....     | Fo       | 8.48      | 3       |                 |
| 66 171.....  | 1 51.0  | 67 65     | .....     | Ao       | 7.70      | 5       |                 |
| 66 173.....  | 1 51.3  | 66 44     | .....     | A2       | 8.42      | 4       |                 |
| 60 308.....  | 1 51.5  | 61 12     | 6.05      | B8       | 5.86      | 3       |                 |
| 66 175.....  | 1 51.6  | 66 33     | 7.35      | A3       | 7.37      | 5       | S               |
| 63 265.....  | 1 52.2  | 64 08     | 5.18      | Ao       | 5.56      | 3       | S P.D.M. = 5.59 |
| 72 114.....  | 1 52.3  | 72 55     | .....     | G5       | 8.52      | 2       |                 |
| 70 153.....  | 1 53.7  | 70 25     | 4.61      | A3       | 5.00      | 4       | S               |

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| 59° 380..... | 1 <sup>h</sup> 54 <sup>m</sup> 3 | 60° 01'   | .....        | Fo          | 7.48         | 3       |                 |
| 73 108.....  | 1 54.4                           | 73 22     | 6.24         | A3          | 6.44         | 8       | S               |
| 03 273.....  | 1 54.9                           | 64 09     | .....        | Fo          | 8.56         | 2       |                 |
| 04 282.....  | 1 55.4                           | 64 25     | 5.92         | A2          | 6.14         | 4       | S               |
| 63 274.....  | 1 55.6                           | 63 54     | 5.62         | B5p         | 6.08         | 3       | S P.D.M. = 5.82 |
| 75 86.....   | 1 55.9                           | 75 38     | 5.30         | G5          | 6.69         | 3       |                 |
| 70 157.....  | 1 56.0                           | 70 44     | 7.64         | Fo          | 7.87         | 7       |                 |
| 73 112.....  | 1 56.9                           | 74 06     | 7.50         | Ao          | 7.64         | 7       | S               |
| 64 285.....  | 1 57.1                           | 64 37     | 6.48         | Ao          | 6.52         | 4       | S               |
| 67 181.....  | 1 57.4                           | 68 07     | .....        | A2          | 8.04         | 6       |                 |
| 63 281.....  | 1 57.6                           | 63 54     | .....        | B3          | 7.24         | 3       |                 |
| 74 95.....   | 1 57.9                           | 74 24     | 7.64         | A2          | 7.67         | 7       | S               |
| 63 287.....  | 1 58.1                           | 63 49     | .....        | B           | 8.16         | 3       |                 |
| 62 344.....  | 1 58.1                           | 62 28     | .....        | F8          | 8.57         | 2       |                 |
| 62 345.....  | 1 58.6                           | 62 42     | .....        | Ko          | 8.30         | 3       |                 |
| 63 296.....  | 1 58.9                           | 64 06     | .....        | Ao          | 8.04         | 4       |                 |
| 66 183.....  | 1 59.2                           | 67 09     | .....        | Ao          | 8.62         | 2       |                 |
| 70 163.....  | 2 0 4                            | 71 05     | 6.74         | F8          | 7.02         | 10      |                 |
| 62 349.....  | 2 0.6                            | 62 41     | .....        | Ao          | 8.11         | 3       |                 |
| 64 295.....  | 2 1.1                            | 64 33     | 7.54         | B3          | 7.50         | 4       |                 |
| 62 357.....  | 2 3.2                            | 63 07     | .....        | Ao          | 8.16         | 3       |                 |
| 73 121.....  | 2 4.1                            | 73 33     | 6.19         | G5          | 7.23         | 8       |                 |
| 68 153.....  | 2 5.1                            | 68 54     | 7.95         | Ao          | 8.12         | 7       |                 |
| 64 307.....  | 2 6.2                            | 64 23     | 7.40         | A2          | 7.46         | 5       | S               |
| 67 189.....  | 2 6.4                            | 67 39     | .....        | Fo          | 8.20         | 7       |                 |
| 66 191.....  | 2 6.4                            | 66 16     | .....        | Ko          | 8.47         | 4       |                 |
| 65 242.....  | 2 7.1                            | 65 51     | 7.35         | F5          | 7.41         | 5       |                 |
| 64 309.....  | 2 7.3                            | 64 33     | 8.14         | F8          | 8.56         | 2       |                 |
| 63 310.....  | 2 7.6                            | 63 34     | .....        | B5p         | 7.98         | 4       |                 |
| 72 121.....  | 2 8.4                            | 72 52     | .....        | Ao          | 8.11         | 8       |                 |
| 64 312.....  | 2 9.2                            | 64 30     | 8.40         | Go          | 8.04         | 4       |                 |
| 64 313.....  | 2 9.7                            | 64 48     | 7.05         | F8          | 7.97         | 4       |                 |
| 64 314.....  | 2 10.4                           | 65.08     | 7.60         | F8          | 7.87         | 4       |                 |
| 63 315.....  | 2 11.1                           | 63 58     | 7.05         | B5p         | 7.60         | 4       |                 |
| 63 316.....  | 2 11.3                           | 63 29     | 7.60         | A3          | 7.68         | 4       | S               |
| 63 320.....  | 2 12.5                           | 63 52     | 6.49         | Ao          | 6.57         | 4       | S               |
| 63 322.....  | 2 12.9                           | 63 25     | .....        | Ko          | 8.62         | 3       |                 |
| 65 248.....  | 2 13.1                           | 65 20     | 8.25         | A2          | 8.07         | 4       |                 |
| 73 131.....  | 2 14.3                           | 73 21     | .....        | F5          | 8.20         | 8       |                 |
| 69 144.....  | 2 14.3                           | 69 52     | .....        | F5          | 8.25         | 9       |                 |
| 68 166.....  | 2 14.5                           | 68 19     | 7.40         | G5          | 8.38         | 7       |                 |
| 75 94.....   | 2 14.6                           | 75 41     | 7.57         | Ao          | 7.67         | 3       |                 |
| 64 321.....  | 2 14.6                           | 64 47     | 7.25         | F8          | 7.59         | 4       |                 |
| 62 383.....  | 2 14.9                           | 62 31     | .....        | A3          | 7.55         | 4       |                 |
| 72 128.....  | 2 15.3                           | 73 03     | 8.04         | Ao          | 8.20         | 8       |                 |

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| 63° 330..... | 2 <sup>h</sup> 17 <sup>m</sup> 4 | 64° 07'   | .....        | Ao          | 8.45         | 4       |               |
| 60 472.....  | 2 18.2                           | 01 04     | 7.11         | B8          | 7.09         | 2       | S             |
| 73 139.....  | 2 18.4                           | 73 16     | 7.22         | Fo          | 7.58         | 8       |               |
| 71 140.....  | 2 18.8                           | 71 41     | 7.67         | B8          | 7.70         | 10      |               |
| 64 327.....  | 2 20.0                           | 65 01     | .....        | Ao          | 8.57         | 3       |               |
| 73 142.....  | 2 20.6                           | 74 11     | .....        | Go          | 8.05         | 2       |               |
| 62 402.....  | 2 20.9                           | 62 44     | 7.41         | Ao          | 7.77         | 4       | S P.D.M.=7.78 |
| 66 214.....  | 2 21.3                           | 66 58     | .....        | Ao          | 8.29         | 9       |               |
| 70 181.....  | 2 23.2                           | 71 10     | .....        | Ao          | 8.43         | 2       |               |
| 69 155.....  | 2 23.3                           | 69 50     | .....        | F8          | 8.47         | 6       |               |
| 69 157.....  | 2 23.5                           | 69 41     | .....        | F5          | 8.29         | 9       |               |
| 69 158.....  | 2 24.3                           | 69 46     | .....        | Fo          | 8.28         | 7       |               |
| 70 182.....  | 2 24.4                           | 70 30     | .....        | B3          | 7.64         | 10      |               |
| 61 422.....  | 2 24.8                           | 61 22     | .....        | Ao          | 7.66         | 2       |               |
| 70 183.....  | 2 24.9                           | 70 51     | 6.73         | Ko          | 7.70         | 11      |               |
| 60 502.....  | 2 25.1                           | 61 01     | 7.82         | B           | 7.68         | 2       |               |
| 69 160.....  | 2 25.6                           | 69 24     | .....        | Ao          | 8.53         | 4       |               |
| 66 219.....  | 2 25.9                           | 66 59     | .....        | Ao          | 7.81         | 9       |               |
| 70 189.....  | 2 26.1                           | 70 12     | 8.19         | Fo          | 8.39         | 7       |               |
| 64 333.....  | 2 26.6                           | 64 21     | .....        | B8          | 8.50         | 4       |               |
| 65 272.....  | 2 27.0                           | 65 37     | 7.10         | Ko          | 7.82         | 5       |               |
| 67 215.....  | 2 27.2                           | 67 55     | 6.77         | F2          | 6.95         | 10      |               |
| 62 420.....  | 2 27.7                           | 62 48     | 7.37         | Go          | 8.27         | 3       |               |
| 74 111.....  | 2 27.8                           | 75 06     | 7.77         | A3          | 8.18         | 4       | S             |
| 66 223.....  | 2 27.9                           | 67 02     | 7.37         | F2          | 7.42         | 9       |               |
| 72 140.....  | 2 28.5                           | 72 23     | 5.34         | Ko          | 6.38         | 9       |               |
| 62 426.....  | 2 28.7                           | 63 03     | 7.67         | Ko          | 8.39         | 2       |               |
| 68 176.....  | 2 28.8                           | 68 38     | 7.42         | Ko          | 8.31         | 9       |               |
| 70 191.....  | 2 29.2                           | 70 28     | .....        | Fo          | 8.47         | 2       |               |
| 65 280.....  | 2 29.4                           | 65 19     | 6.07         | Ko          | 7.40         | 6       |               |
| 63 343.....  | 2 29.5                           | 63 40     | 7.52         | F8          | 7.87         | 3       |               |
| 67 217.....  | 2 29.8                           | 67 38     | .....        | Fo          | 7.86         | 10      |               |
| 68 177.....  | 2 30.1                           | 68 52     | .....        | A2          | 8.02         | 10      |               |
| 70 197.....  | 2 30.7                           | 70 48     | .....        | Ko          | 8.47         | 3       |               |
| 71 153.....  | 2 30.8                           | 71 52     | .....        | Ao          | 8.45         | 8       |               |
| 61 448.....  | 2 32.3                           | 62 10     | 7.28         | Ao          | 7.37         | 3       | S             |
| 70 198.....  | 2 32.6                           | 71 12     | 7.41         | Ko          | 8.25         | 10      |               |
| 69 171.....  | 2 32.7                           | 60 16     | .....        | Ao          | 7.44         | 10      |               |
| 67 221.....  | 2 33.2                           | 68 03     | .....        | B8          | 7.37         | 6       |               |
| 67 222.....  | 2 33.7                           | 67 38     | .....        | K2          | 8.27         | 9       |               |
| 61 462.....  | 2 34.6                           | 61 56     | 7.24         | Ao          | 7.31         | 2       | S             |
| 60 548.....  | 2 34.9                           | 61 10     | 6.99         | Fo          | 7.18         | 3       |               |
| 68 180.....  | 2 35.8                           | 68 14     | .....        | A3          | 8.05         | 6       |               |
| 74 117.....  | 2 36.1                           | 74 59     | 7.12         | A3          | 7.44         | 4       | S             |
| 67 224.....  | 2 36.2                           | 67 24     | 5.84         | A2          | 6.20         | 9       | S             |

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| 67° 226..... | 2 <sup>h</sup> 37 <sup>m</sup> 4 | 67° 23'   | .....        | A2          | 8.46         | 5       | Var.?   |
| 71 165.....  | 2 37.6                           | 71 18     | .....        | Fo          | 8.33         | 8       |         |
| 65 289.....  | 2 37.6                           | 65 19     | .....        | B8          | 8.22         | 5       |         |
| 71 167.....  | 2 39.3                           | 71 56     | 8.06         | G5          | 8.46         | 9       |         |
| 59 541.....  | 2 39.5                           | 60 09     | 6.68         | A5          | 6.91         | 2       |         |
| 71 171.....  | 2 40.1                           | 71 21     | .....        | G5          | 8.51         | 7       |         |
| 60 180.....  | 2 40.1                           | 70 04     | 8.39         | F2          | 8.48         | 9       |         |
| 72 145.....  | 2 40.3                           | 72 30     | 7.86         | B8          | 7.93         | 12      | S       |
| 62 468.....  | 2 40.8                           | 62 52     | .....        | B9          | 8.21         | 4       |         |
| 64 351.....  | 2 41.8                           | 64 14     | 7.48         | B9          | 7.53         | 7       | S       |
| 74 120.....  | 2 42.2                           | 74 19.5   | 7.59         | A2          | 7.69         | 5       | S       |
| 72 146.....  | 2 42.9                           | 72 52     | 7.29         | G5          | 8.29         | 10      |         |
| 59 552.....  | 2 43.2                           | 60 01     | 7.11         | Bo          | 7.19         | 2       |         |
| 65 300.....  | 2 43.7                           | 65 13     | 7.10         | A2          | 7.22         | 7       | S       |
| 62 479.....  | 2 44.3                           | 63 00     | 6.94         | Go          | 7.16         | 4       |         |
| 64 354.....  | 2 44.7                           | 64 14     | 7.69         | F2          | 7.92         | 6       |         |
| 59 559.....  | 2 45.2                           | 60 03     | 7.36         | A3          | 7.43         | 2       |         |
| 74 123.....  | 2 45.4                           | 74 46     | 7.87         | F5          | 8.28         | 4       |         |
| 72 149.....  | 2 45.4                           | 73 58     | 6.82         | G5          | 7.84         | 8       |         |
| 72 152.....  | 2 46.2                           | 72 29     | 7.66         | Go          | 8.08         | 10      |         |
| 63 367.....  | 2 47.0                           | 63 43     | 7.78         | Bp          | 8.10         | 5       | S       |
| 65 306.....  | 2 47.6                           | 65 24     | 7.55         | Ao          | 7.44         | 6       |         |
| 68 208.....  | 2 47.8                           | 68 25     | .....        | B8          | 7.83         | 9       |         |
| 67 234.....  | 2 48.0                           | 67 47     | .....        | Go          | 8.28         | 11      |         |
| 60 591.....  | 2 48.0                           | 61 07     | 5.63         | F5          | 5.91         | 2       |         |
| 71 179.....  | 2 48.3                           | 71 45     | .....        | B9          | 8.32         | 10      |         |
| 64 356.....  | 2 49.6                           | 64 40     | .....        | A2          | 8.44         | 6       |         |
| 63 370.....  | 2 49.7                           | 64 01     | 6.92         | G5          | 7.71         | 7       |         |
| 67 496.....  | 2 49.8                           | 62 53     | 7.78         | Ko          | 8.19         | 2       |         |
| 60 597.....  | 2 49.8                           | 60 43     | .....        | B9          | 7.70         | 2       |         |
| 68 212.....  | 2 51.0                           | 60 05     | .....        | A2          | 8.00         | 9       |         |
| 60 608.....  | 2 51.9                           | 60 53     | 7.00         | B2          | 6.89         | 2       |         |
| 62 504.....  | 2 52.4                           | 62 19     | .....        | B           | 8.28         | 4       |         |
| 71 180.....  | 2 52.5                           | 71 37     | .....        | Ao          | 8.52         | 3       |         |
| 72 154.....  | 2 52.6                           | 72 13     | .....        | Ao          | 8.48         | 6       |         |
| 74 131.....  | 2 53.3                           | 74 45     | 7.02         | B9          | 7.11         | 5       | S       |
| 70 219.....  | 2 54.2                           | 70 16     | 8.44         | Ao          | 8.31         | 5       | S       |
| 73 165.....  | 2 54.8                           | 73 33     | 7.49         | Ao          | 7.49         | 8       |         |
| 61 513.....  | 2 55.9                           | 61 21     | 6.67         | Go          | 7.31         | 2       |         |
| 70 220.....  | 2 56.2                           | 70 38     | .....        | Go          | 8.41         | 4       |         |
| 64 365.....  | 2 56.6                           | 65 09     | 8.15         | F8          | 8.40         | 6       |         |
| 70 225.....  | 2 56.9                           | 71 08     | .....        | Ao          | 8.41         | 6       |         |
| 62 512.....  | 2 57.1                           | 62 38     | 7.42         | B8          | 7.44         | 5       | S       |
| 64 366.....  | 2 57.2                           | 64 46     | 7.27         | Ko          | 8.30         | 7       |         |
| 64 367.....  | 2 57.5                           | 65 03     | 8.05         | A5          | 8.01         | 7       |         |

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| 66° 242..... | 2 <sup>h</sup> 57 <sup>m</sup> 9 | 67°01'    | .....     | G0       | 8.41      | 6       |                 |
| 69 196.....  | 2 58.1                           | 69 51     | 8.24      | A5       | 8.31      | 6       |                 |
| 62 516.....  | 2 58.3                           | 62 25     | .....     | Ao       | 8.38      | 2       |                 |
| 72 156.....  | 2 58.6                           | 72 26     | .....     | Ao       | 8.56      | 2       |                 |
| 63 390.....  | 2 58.9                           | 63 41     | 5.82      | B9       | 5.87      | 5       | S               |
| 69 190.....  | 2 59.9                           | 69 24     | .....     | Ao       | 8.22      | 7       |                 |
| 61 525.....  | 3 0.7                            | 62 00     | 6.54      | Bo       | 6.68      | 2       |                 |
| 63 395.....  | 3 0.9                            | 63 55     | 6.87      | G5       | 7.81      | 4       |                 |
| 67 246.....  | 3 1.0                            | 67 59     | .....     | A2       | 8.19      | 9       |                 |
| 73 168.....  | 3 1.1                            | 74 01     | 4.89      | A2       | 4.55      | 4       | S               |
| 73 160.....  | 3 1.8                            | 73 49     | .....     | Fo       | 7.93      | 8       |                 |
| 65 325.....  | 3 2.4                            | 65 30     | .....     | Ao       | 8.37      | 5       |                 |
| 64 375.....  | 3 2.5                            | 64 31     | 6.52      | A5       | 6.66      | 7       | S               |
| 63 298.....  | 3 2.5                            | 63 25     | 7.38      | F8       | 7.74      | 4       |                 |
| 73 170.....  | 3 2.6                            | 73 55     | 7.46      | F8       | 7.76      | 8       |                 |
| 70 230.....  | 3 2.7                            | 71 11     | 7.68      | F8       | 8.07      | 11      |                 |
| 64 376.....  | 3 3.5                            | 64 43     | .....     | Fo       | 7.57      | 7       |                 |
| 60 636.....  | 3 3.5                            | 60 15     | 7.26      | Ao       | 7.44      | 2       | S P.D.M. = 7.49 |
| 65 326.....  | 3 3.8                            | 65 31     | .....     | A2       | 8.24      | 5       |                 |
| 61 535.....  | 3 4.1                            | 62 11     | .....     | Ao       | 8.09      | 3       |                 |
| 73 172.....  | 3 4.4                            | 73 30     | 6.80      | Ko       | 8.18      | 9       |                 |
| 67 250.....  | 3 4.6                            | 68 10     | 7.72      | G5       | 8.44      | 6       |                 |
| 63 402.....  | 3 4.9                            | 63 13     | .....     | B9       | 8.47      | 2       |                 |
| 61 540.....  | 3 6.4                            | 61 21     | .....     | Ao       | 7.83      | 2       |                 |
| 63 403.....  | 3 6.5                            | 63 35     | .....     | B8       | 8.41      | 2       |                 |
| 69 302.....  | 3 7.0                            | 69 37     | .....     | Ao       | 7.48      | 10      |                 |
| 64 378.....  | 3 7.1                            | 64 33     | .....     | F8       | 8.37      | 5       |                 |
| 60 651.....  | 3 7.5                            | 60 45     | .....     | B8       | 7.51      | 2       |                 |
| 72 166.....  | 3 7.8                            | 72 25     | .....     | F2       | 8.37      | 5       |                 |
| 68 230.....  | 3 7.9                            | 69 04     | .....     | Ao       | 7.83      | 10      |                 |
| 74 144.....  | 3 8.6                            | 74 52     | 7.47      | B9       | 7.32      | 4       | S               |
| 65 338.....  | 3 8.8                            | 65 17     | 6.35      | A2       | 6.42      | 8       | S               |
| 73 179.....  | 3 10.3                           | 73 20     | 7.10      | Ko       | 8.06      | 8       |                 |
| 69 203.....  | 3 10.5                           | 69 22     | 6.68      | Ao       | 6.50      | 10      | S               |
| 66 253.....  | 3 10.5                           | 66 51     | .....     | F8       | 8.25      | 11      |                 |
| 67 256.....  | 3 11.5                           | 68 06     | 7.58      | Ko       | 7.96      | 9       |                 |
| 67 257.....  | 3 11.7                           | 67 24     | .....     | F5       | 7.89      | 9       |                 |
| 73 180.....  | 3 12.9                           | 73 49     | 6.94      | F8       | 7.18      | 7       |                 |
| 70 241.....  | 3 12.9                           | 70 55     | 7.53      | Fo       | 7.59      | 11      |                 |
| 61 559.....  | 3 13.1                           | 61 38     | 6.65      | B8       | 6.52      | 3       | S               |
| 70 242.....  | 3 13.5                           | 71 03     | 7.73      | B8       | 8.12      | 11      |                 |
| 72 172.....  | 3 15.1                           | 72 51     | 7.30      | Ko       | 8.31      | 6       |                 |
| 71 197.....  | 3 15.1                           | 71 20     | .....     | B8       | 7.47      | 11      |                 |
| 64 391.....  | 3 16.0                           | 64 14     | 5.55      | Mo       | 7.35      | 5       |                 |
| 71 198.....  | 3 16.3                           | 71 51     | 7.18      | Fo       | 7.09      | 9       |                 |

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| 68° 242..... | 3 16 <sup>m</sup> 3 | 68° 48'   | .....        | F8          | 8.30         | 3       |         |
| 65 345.....  | 3 17.9              | 65 51     | 7.28         | Ko          | 8.34         | 4       |         |
| 62 566.....  | 3 18.1              | 62 50     | 7.32         | Go          | 8.18         | 4       |         |
| 72 173.....  | 3 18.4              | 72 14     | .....        | A3          | 8.40         | 4       |         |
| 74 151.....  | 3 18.5              | 74 54     | 7.92         | Ao          | 7.97         | 5       |         |
| 59 655.....  | 3 18.7              | 60 03     | 7.66         | A2          | 7.61         | 3       | S       |
| 68 249.....  | 3 19.3              | 68 56     | 7.52         | F5          | 7.51         | 8       |         |
| 68 250.....  | 3 19.7              | 69 07     | 7.68         | Ao          | 7.56         | 10      | S       |
| 71 201.....  | 3 19.9              | 71 31     | 6.83         | Ma          | 8.10         | 10      |         |
| 67 270.....  | 3 20.8              | 68 06     | .....        | B8          | 7.60         | 6       |         |
| 71 202.....  | 3 21.0              | 71 50     | .....        | Ao          | 8.15         | 10      |         |
| 71 203.....  | 3 21.0              | 71 40     | .....        | Ao          | 8.04         | 11      |         |
| 71 204.....  | 3 21.0              | 71 31     | .....        | Ao          | 7.77         | 11      |         |
| 72 178.....  | 3 24.2              | 73 01     | 6.41         | Ao          | 6.55         | 8       | S       |
| 65 348.....  | 3 24.5              | 65 12     | 7.04         | A2          | 7.13         | 6       | S       |
| 74 158.....  | 3 25.3              | 74 18     | .....        | F8          | 8.21         | 3       |         |
| 68 258.....  | 3 25.6              | 68 27     | .....        | A2          | 8.43         | 2       |         |
| 63 426.....  | 3 25.9              | 63 34     | 7.68         | B3          | 7.89         | 3       |         |
| 74 161.....  | 3 27.0              | 74 24     | 7.60         | Ko          | 8.32         | 4       |         |
| 67 277.....  | 3 27.0              | 67 38     | .....        | F8          | 8.29         | 8       |         |
| 63 430.....  | 3 27.1              | 63 55     | .....        | B8          | 8.05         | 4       |         |
| 73 190.....  | 3 27.6              | 74 08     | .....        | A2          | 8.39         | 2       |         |
| 64 398.....  | 3 28.2              | 65 01     | 8.00         | F8          | 8.32         | 6       |         |
| 62 584.....  | 3 28.7              | 62 37     | 7.84         | Ao          | 8.59         | 4       |         |
| 65 353.....  | 3 30.0              | 65 19     | 7.40         | Ao          | 7.42         | 5       |         |
| 63 436.....  | 3 31.0              | 63 58     | 7.30         | F8          | 7.81         | 4       |         |
| 66 279.....  | 3 31.3              | 66 38     | .....        | Fo          | 8.48         | 2       |         |
| 72 184.....  | 3 32.0              | 73 05     | .....        | F8          | 8.45         | 2       |         |
| 69 222.....  | 3 32.6              | 69 32     | 7.13         | A3          | 7.07         | 8       | S       |
| 65 357.....  | 3 32.7              | 65 48     | .....        | A2          | 7.74         | 5       |         |
| 74 168.....  | 3 33.5              | 74 13     | 6.82         | G5          | 7.64         | 8       |         |
| 62 507.....  | 3 33.5              | 62 54     | 5.32         | Ma          | 6.78         | 5       |         |
| 72 187.....  | 3 34.9              | 72 43     | .....        | Go          | 8.37         | 4       |         |
| 71 216.....  | 3 35.7              | 71 18     | 7.08         | G5          | 7.75         | 10      |         |
| 66 284.....  | 3 36.5              | 66 53     | 5.84         | F2          | 6.10         | 7       |         |
| 60 735.....  | 3 36.5              | 61 09     | 7.52         | A2          | 7.71         | 3       | S       |
| 69 225.....  | 3 37.4              | 69 54     | 8.49         | Fo          | 8.28         | 5       |         |
| 70 257.....  | 3 38.8              | 70 34     | 5.56         | Ao          | 5.57         | 9       | S       |
| 70 259.....  | 3 39.8              | 71 02     | 4.67         | Ao          | 4.98         | 3       |         |
| 64 408.....  | 3 39.9              | 64 27     | .....        | F5          | 7.68         | 5       |         |
| 66 290.....  | 3 40.2              | 66 51     | .....        | G5          | 8.01         | 7       |         |
| 65 369.....  | 3 40.4              | 65 13     | 4.71         | Ma          | 6.33         | 5       |         |
| 62 612.....  | 3 40.8              | 63 00     | 5.96         | A3          | 5.93         | 4       | S       |
| 68 283.....  | 3 41.0              | 68 48     | 7.21         | Ko          | 7.89         | 7       |         |
| 70 262.....  | 3 41.4              | 70 12     | 7.39         | A3          | 7.35         | 8       |         |

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| B.D. No.     | R.A. 1900                                     | Dec. 1900 | H.R.<br>Mag. | H.D.<br>Sp. | Ptg.<br>Mag. | No. Pl. | Remarks         |
|--------------|---|-----------|--------------|-------------|--------------|---------|-----------------|
| 72° 192..... | 3 <sup>h</sup> 41 <sup>m</sup> 5 <sup>s</sup> | 72°54'    | .....        | Ao          | 8.15         | 8       | S               |
| 68 286.....  | 3 41.8  | 68 12     | 6.33         | B8          | 6.17         | 9       |                 |
| 67 296.....  | 3 43.0  | 67 16     | .....        | Fo          | 7.48         | 8       |                 |
| 61 644.....  | 3 43.7  | 62 02     | 6.82         | A2          | 6.69         | 3       |                 |
| 63 458.....  | 3 44.3  | 63 11     | 8.10         | B5          | 7.76         | 3       |                 |
| 64 412.....  | 3 44.6  | 64 26     | .....        | F8          | 7.91         | 5       |                 |
| 73 204.....  | 3 44.9  | 73 47     | 6.99         | Ko          | 8.21         | 8       |                 |
| 71 222.....  | 3 45.8  | 71 32     | 6.39         | Fo          | 6.52         | 9       |                 |
| 72 199.....  | 3 46.9  | 72 26     | 6.75         | Ko          | 7.78         | 10      |                 |
| 69 231.....  | 3 46.9  | 69 14     | .....        | G5          | 8.38         | 3       |                 |
| 62 628.....  | 3 48.6  | 62 47     | 4.87         | B9          | 5.39         | 3       | S P.D.M. = 5.20 |
| 60 768.....  | 3 48.6  | 60 49     | 5.22         | K4          | 6.42         | 4       |                 |
| 67 299.....  | 3 48.7  | 68 05     | .....        | Fo          | 7.88         | 7       |                 |
| 67 300.....  | 3 48.9  | 67 44     | 7.36         | G5          | 8.14         | 9       |                 |
| 62 629.....  | 3 48.9  | 62 29     | .....        | F2          | 7.91         | 3       |                 |
| 65 381.....  | 3 49.4  | 65 17     | 7.90         | Ao          | 7.79         | 7       |                 |
| 66 301.....  | 3 51.6  | 66 46     | .....        | A2          | 8.35         | 4       |                 |
| 62 643.....  | 3 54.1  | 62 09     | 7.28         | B5          | 7.14         | 3       | S               |
| 74 184.....  | 3 54.9  | 74 55     | 7.32         | F8          | 7.56         | 5       |                 |
| 74 186.....  | 3 55.3  | 74 22     | 6.86         | Ko          | 7.53         | 6       |                 |
| 73 210.....  | 3 55.4  | 73 43     | 6.72         | Ko          | 7.42         | 9       |                 |
| 68 303.....  | 3 55.9  | 68 24     | 6.14         | K2          | 7.45         | 9       |                 |
| 61 665.....  | 3 56.1  | 62 03     | 7.68         | F5          | 7.16         | 2       |                 |
| 70 274.....  | 3 56.3  | 70 11     | 8.59         | B9          | 8.18         | 3       | S               |
| 65 391.....  | 3 57.3  | 65 14     | 6.07         | A2          | 6.20         | 7       |                 |
| 64 424.....  | 3 57.3  | 64 45     | .....        | A3          | 7.96         | 6       |                 |
| 61 669.....  | 3 57.4  | 61 48     | 6.75         | B2          | 6.60         | 2       |                 |
| 69 235.....  | 3 57.5  | 69 36     | .....        | Ao          | 8.29         | 7       |                 |
| 73 212.....  | 3 57.7  | 73 18     | 6.88         | F5          | 7.12         | 9       |                 |
| 70 276.....  | 3 58.2  | 71 04     | 7.49         | B9          | 7.42         | 9       |                 |
| 74 188.....  | 3 58.7  | 74 24     | .....        | A3          | 8.47         | 2       |                 |
| 61 673.....  | 3 58.7  | 62 08     | .....        | Ao          | 7.67         | 2       |                 |
| 69 238.....  | 3 59.3  | 69 17     | .....        | G5          | 8.36         | 6       |                 |
| 60 780.....  | 3 59.8  | 60 37     | 7.46         | B9          | 7.28         | 4       |                 |
| 67 310.....  | 4 0.0   | 68 07     | 7.32         | Fo          | 7.34         | 7       |                 |
| 69 240.....  | 4 0.1   | 70 05     | 8.09         | G5          | 8.40         | 4       |                 |
| 71 239.....  | 4 2.6   | 71 52     | 6.15         | G5          | 7.01         | 9       |                 |
| 68 310.....  | 4 2.8   | 68 16     | 6.41         | Ko          | 7.45         | 7       |                 |
| 67 312.....  | 4 2.9   | 68 05     | .....        | A2          | 8.34         | 2       |                 |
| 70 281.....  | 4 3.8   | 70 57     | .....        | .....       | 7.83         | 12      |                 |
| 72 198.....  | 4 3.9   | 72 47     | .....        | A2          | 8.29         | 6       |                 |
| 69 243.....  | 4 4.0   | 69 16     | 7.27         | Ko          | 8.42         | 5       |                 |
| 70 286.....  | 4 6.4   | 70 12     | 7.79         | K2          | 8.26         | 3       |                 |
| 74 194.....  | 4 6.5   | 74 23     | .....        | K2          | 7.26         | 5       |                 |
| 66 316.....  | 4 8.1   | 66 51     | 6.94         | B8          | 6.60         | 7       | S               |

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| B.D. No.     | R.A. 1900                                    | Dec. 1900 | H.R. Mag. | H.D. Sp. | Ptg. Mag. | No. Pl. | Remarks |
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| 61° 687..... | 4 <sup>h</sup> 8 <sup>m</sup> 1 <sup>s</sup> | 61° 36'   | 5.64      | B8       | 5.54      | 2       |         |
| 67 319.....  | 4 9.9  | 67 38     | .....     | F8       | 8.37      | 4       |         |
| 63 491.....  | 4 10.0                                       | 63 43     | .....     | Fo       | 7.80      | 4       |         |
| 60 792.....  | 4 10.0                                       | 60 14     | 7.41      | B9       | 7.48      | 3       |         |
| 61 694.....  | 4 10.4                                       | 61 22     | .....     | A3       | 7.81      | 4       | S       |
| 64 433.....  | 4 11.2                                       | 64 54     | 5.40      | Go       | 6.06      | 6       |         |
| 70 293.....  | 4 11.7                                       | 70 48     | .....     | Ao       | 8.45      | 4       |         |
| 66 318.....  | 4 12.6                                       | 67 03     | .....     | Fo       | 8.24      | 3       |         |
| 60 799.....  | 4 12.9                                       | 60 33     | .....     | B9       | 7.76      | 4       |         |
| 60 800.....  | 4 13.1                                       | 60 30     | 5.67      | Ko       | 7.00      | 4       |         |
| 68 320.....  | 4 13.4                                       | 68 53     | .....     | G5       | 8.43      | 5       |         |
| 67 325.....  | 4 14.2                                       | 67 41     | .....     | F2       | 8.02      | 7       |         |
| 71 250.....  | 4 15.8                                       | 71 33     | 7.52      | B8       | 7.54      | 9       |         |
| 67 327.....  | 4 16.4                                       | 67 49     | .....     | B9       | 7.98      | 6       |         |
| 71 254.....  | 4 17.8                                       | 71 27     | .....     | Fo       | 8.34      | 8       |         |
| 67 329.....  | 4 18.1                                       | 67 28     | .....     | F2       | 8.05      | 7       |         |
| 69 258.....  | 4 19.4                                       | 69 09     | 7.02      | Ko       | 8.24      | 9       |         |
| 72 224.....  | 4 20.3                                       | 73 02     | .....     | Go       | 8.43      | 2       |         |
| 68 329.....  | 4 20.3                                       | 69 02     | .....     | Ao       | 8.36      | 7       |         |
| 62 683.....  | 4 20.9                                       | 62 29     | .....     | A3       | 7.76      | 2       |         |
| 64 449.....  | 4 21.1                                       | 64 50     | .....     | Fo       | 7.89      | 4       |         |
| 72 227.....  | 4 21.9                                       | 72 19     | 5.97      | A5       | 6.14      | 9       | S       |
| 69 261.....  | 4 23.0                                       | 69 23     | .....     | G5       | 8.41      | 5       |         |
| 67 334.....  | 4 23.1                                       | 67 25     | 6.86      | A2       | 6.93      | 5       | S       |
| 72 228.....  | 4 23.4                                       | 72 44     | .....     | Ko       | 8.29      | 2       |         |
| 68 334.....  | 4 23.6                                       | 68 58     | .....     | A2       | 8.40      | 3       |         |
| 64 457.....  | 4 23.7                                       | 64 46     | 7.40      | F5       | 7.78      | 5       |         |
| 70 305.....  | 4 23.8                                       | 70 08     | .....     |          | 7.72      | 4       |         |
| 63 511.....  | 4 24.0                                       | 63 57     | 7.03      | G5       | 8.35      | 3       |         |
| 61 718.....  | 4 25.2                                       | 61 40     | .....     | A3       | 8.34      | 3       |         |
| 73 237.....  | 4 25.6                                       | 23 56     | .....     | Fo       | 8.40      | 3       |         |
| 71 263.....  | 4 26.4                                       | 71 41     | .....     | A2       | 7.84      | 9       |         |
| 67 339.....  | 4 27.1                                       | 68 05     | 7.37      | B8       | 7.21      | 5       |         |
| 63 515.....  | 4 27.1                                       | 64 03     | 5.91      | Ao       | 5.88      | 2       | S       |
| 61 720.....  | 4 27.5                                       | 61 10     | 7.22      | K2       | 8.17      | 3       | S       |
| 72 230.....  | 4 27.6                                       | 72 22     | .....     | F5       | 8.44      | 3       |         |
| 66 335.....  | 4 29.1                                       | 67 01     | .....     | Ao       | 7.68      | 5       |         |
| 60 825.....  | 4 29.1                                       | 60 28     | 7.86      | G5       | 8.31      | 3       |         |
| 68 340.....  | 4 29.4                                       | 68 55     | .....     | Ao       | 7.86      | 7       |         |
| 60 826.....  | 4 29.4                                       | 60 41     | 6.77      | Ko       | 8.26      | 3       |         |
| 62 395.....  | 4 30.3                                       | 63 01     | .....     | A2       | 7.63      | 2       |         |
| 64 469.....  | 4 30.8                                       | 64 21     | .....     | G5       | 7.94      | 3       |         |
| 72 233.....  | 4 30.9                                       | 72 47     | .....     | Fo       | 8.26      | 5       |         |
| 69 267.....  | 4 31.8                                       | 69 45     | .....     | B9       | 8.17      | 8       |         |
| 67 343.....  | 4 33.4                                       | 67 57     | .....     | Ao       | 7.75      | 5       |         |

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|--------------|----------------------------------|-----------|-----------|----------|-----------|---------|---------|
| 75° 189..... | 4 <sup>h</sup> 35 <sup>m</sup> 4 | 75° 46'   | 6.04      | Fo       | 6.17      | 3       |         |
| 72 236.....  | 4 35.6                           | 72 58     | .....     | A2       | 8.33      | 2       |         |
| 67 347.....  | 4 38.1                           | 67 35     | 6.97      | Fo       | 7.15      | 5       |         |
| 63 530.....  | 4 40.8                           | 63 27     | 6.72      | Ao       | 6.68      | 2       |         |
| 72 242.....  | 4 42.1                           | 72 53     | .....     | F5       | 8.35      | 3       |         |
|              |                                  |           |           |          |           |         | S       |
| 63 543.....  | 4 42.7                           | 63 20     | 5.81      | Ma       | 7.15      | 2       |         |
| 67 353.....  | 4 43.4                           | 68 03     | 7.42      | Ko       | 8.17      | 5       |         |
| 67 354.....  | 4 43.6                           | 67 20     | 7.49      | F2       | 7.74      | 5       |         |
| 65 435.....  | 4 43.6                           | 65 49     | 7.57      | G5       | 7.94      | 4       |         |
| 61 739.....  | 4 44.7                           | 61 19     | 6.63      | A3       | 6.65      | 2       |         |
|              |                                  |           |           |          |           |         | S       |
| 66 362.....  | 4 45.4                           | 66 46     | .....     | B9       | 8.00      | 6       |         |
| 67 357.....  | 4 47.3                           | 67 38     | 7.14      | B8       | 7.13      | 6       |         |
| 65 439.....  | 4 47.7                           | 65 08     | 6.78      | G5       | 7.80      | 4       |         |
| 71 282.....  | 4 47.9                           | 71 28     | .....     | Ao       | 7.89      | 7       |         |
| 61 742.....  | 4 48.2                           | 61 36     | 6.90      | Go       | 7.75      | 2       |         |
|              |                                  |           |           |          |           |         | S       |
| 67 360.....  | 4 48.3                           | 67 16     | .....     | F8       | 8.26      | 4       |         |
| 69 288.....  | 4 49.2                           | 69 47     | 7.84      | Ao       | 7.77      | 5       |         |
| 74 229.....  | 4 49.6                           | 74 07     | 6.23      | Ko       | 7.78      | 4       |         |
| 68 357.....  | 4 51.3                           | 69 02     | 7.07      | F5       | 7.30      | 4       |         |
| 73 365.....  | 4 52.0                           | 73 55     | 6.00      | A2       | 6.02      | 4       |         |
|              |                                  |           |           |          |           |         | S       |
| 60 853.....  | 4 52.6                           | 60 58     | 6.12      | F5       | 6.47      | 5       |         |
| 66 370.....  | 4 52.7                           | 66 41     | 6.29      | F8       | 6.46      | 3       |         |
| 68 361.....  | 4 55.4                           | 68 50     | 6.80      | F2       | 6.86      | 4       |         |
| 60 857.....  | 4 57.5                           | 61 02     | 6.27      | Ko       | 7.61      | 5       |         |
| 69 301.....  | 4 58.3                           | 69 43     | .....     | B9       | 7.95      | 4       |         |
|              |                                  |           |           |          |           |         | S       |
| 60 302.....  | 4 58.7                           | 69 30     | 6.58      | Ko       | 7.41      | 4       |         |
| 73 274.....  | 4 59.7                           | 73 49     | 5.38      | Aop      | 5.27      | 4       |         |
| 64 500.....  | 5 0.1                            | 64 47     | 6.40      | F2       | 6.61      | 5       |         |
| 72 258.....  | 5 0.4                            | 72 37     | .....     | B8       | 7.36      | 5       |         |
| 62 730.....  | 5 0.5                            | 62 21     | 6.74      | A5       | 6.79      | 3       |         |
|              |                                  |           |           |          |           |         | S       |
| 63 566.....  | 5 1.3                            | 63 27     | 6.66      | Fo       | 6.88      | 4       |         |
| 65 459.....  | 5 1.8                            | 65 53     | .....     | Ao       | 8.27      | 2       |         |
| 67 367.....  | 5 2.1                            | 67 33     | 7.28      | F2       | 7.52      | 4       |         |
| 64 503.....  | 5 2.9                            | 64 10     | .....     | F8       | 8.17      | 4       |         |
| 64 504.....  | 5 3.2                            | 64 37     | .....     | F5       | 8.32      | 3       |         |
|              |                                  |           |           |          |           |         | S       |
| 69 307.....  | 5 3.3                            | 69 42     | 7.24      | Ko       | 7.99      | 2       |         |
| 67 371.....  | 5 3.7                            | 67 21     | 7.12      | Ao       | 7.00      | 2       |         |
| 61 766.....  | 5 3.9                            | 61 44     | 5.99      | Ao       | 6.20      | 4       |         |
| 65 464.....  | 5 4.0                            | 65 56     | 7.88      | F2       | 7.91      | 2       |         |
| 62 734.....  | 5 4.2                            | 62 34     | 6.38      | A2       | 6.83      | 3       |         |
|              |                                  |           |           |          |           |         | S       |
| 67 373.....  | 5 4.4                            | 67 15     | 7.58      | Fo       | 7.72      | 3       |         |
| 74 238.....  | 5 4.6                            | 74 25     | 7.25      | A2       | 7.47      | 2       |         |
| 62 735.....  | 5 5.2                            | 62 59     | 6.74      | Fo       | 7.07      | 3       |         |
| 73 280.....  | 5 5.9                            | 73 09     | 5.76      | Ao       | 5.77      | 4       |         |
| 71 299.....  | 5 8.9                            | 71 36     | 6.76      | G5       | 7.59      | 4       |         |

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|--------------|--|-----------|--------------|-------------|--------------|---------|---------|
| 67° 379..... | 5 <sup>h</sup> 9 <sup>m</sup> 2 <sup>s</sup> | 67° 53'   | 7.38         | A2          | 7.50         | 3       | S       |
| 66 385.....  | 5 10.5                                       | 66 38     | 6.59         | G5          | 7.21         | 4       |         |
| 62 742.....  | 5 11.0                                       | 62 33     | 5.88         | K4          | 7.42         | 3       |         |
| 66 387.....  | 5 11.6                                       | 66 55     | .....        | Ko          | 8.19         | 4       |         |
| 73 285.....  | 5 12.4                                       | 73 36     | 7.03         | Ma          | 8.26         | 3       |         |
| 69 317.....  | 5 12.5                                       | 69 28     | .....        | A5          | 8.20         | 4       |         |
| 66 391.....  | 5 12.7                                       | 66 06     | .....        | Ao          | 8.06         | 2       |         |
| 63 577.....  | 5 14.0                                       | 64 02     | .....        | F8          | 7.71         | 3       |         |
| 73 289.....  | 5 14.5                                       | 73 25     | .....        | Ao          | 8.10         | 4       |         |
| 74 241.....  | 5 14.6                                       | 74 28     | 7.18         | Aop         | 7.30         | 3       | S       |
| 64 523.....  | 5 15.0                                       | 64 38     | 7.65         | F8          | 8.15         | 3       |         |
| 63 579.....  | 5 15.3                                       | 63 17     | 7.27         | Go          | 7.84         | 3       |         |
| 74 242.....  | 5 15.6                                       | 74 13     | 6.94         | B9          | 6.86         | 3       | S       |
| 70 351.....  | 5 15.6                                       | 70 08     | 7.04         | B9          | 7.02         | 3       | S       |
| 61 783.....  | 5 15.8                                       | 61 44     | .....        | B9          | 7.88         | 3       |         |
| 67 384.....  | 5 17.7                                       | 67 34     | .....        | A2          | 8.15         | 3       |         |
| 67 385.....  | 5 18.3                                       | 67 50     | .....        | B8          | 8.09         | 4       |         |
| 67 386.....  | 5 20.0                                       | 67 08     | .....        | A3          | 8.36         | 3       |         |
| 63 585.....  | 5 20.9                                       | 63 52     | .....        | F8          | 8.26         | 3       |         |
| 60 884.....  | 5 20.9                                       | 60 11     | 6.85         | Ao          | 6.87         | 3       | S       |
| 64 532.....  | 5 21.0                                       | 64 15     | .....        | Go          | 8.04         | 3       |         |
| 62 762.....  | 5 22.3                                       | 62 55     | 7.46         | Ao          | 7.45         | 3       | S       |
| 67 390.....  | 5 22.6                                       | 67 56     | 6.92         | Fo          | 6.92         | 3       |         |
| 69 327.....  | 5 23.0                                       | 69 35     | 7.94         | F5          | 8.22         | 3       |         |
| 74 249.....  | 5 23.9                                       | 74 15     | 6.90         | Fo          | 7.16         | 2       |         |
| 74 250.....  | 5 24.4                                       | 74 38     | 7.47         | Go          | 8.02         | 2       |         |
| 70 360.....  | 5 25.0                                       | 71 00     | .....        | Ao          | 8.24         | 4       |         |
| 64 533.....  | 5 25.0                                       | 65 00     | 8.55         | Ao          | 8.31         | 5       |         |
| 64 534.....  | 5 25.0                                       | 64 58     | 7.50         | A2          | 7.17         | 5       |         |
| 68 393.....  | 5 25.6                                       | 69 02     | .....        | F5          | 8.20         | 3       |         |
| 71 313.....  | 5 26.1                                       | 71 35     | 6.82         | G5          | 7.48         | 5       |         |
| 74 252.....  | 5 26.3                                       | 74 59     | 6.36         | K5          | 7.81         | 2       |         |
| 63 592.....  | 5 26.5                                       | 63 25     | .....        | A3          | 7.79         | 4       |         |
| 66 401.....  | 5 27.0                                       | 66 38     | 6.24         | A5          | 6.34         | 4       | S       |
| 70 362.....  | 5 27.5                                       | 70 18     | 6.85         | Ao          | 6.83         | 3       | S       |
| 64 482.....  | 5 27.6                                       | 65 03     | 7.80         | A2          | 7.83         | 5       |         |
| 64 536.....  | 5 27.6                                       | 64 06     | 6.03         | B9          | 6.11         | 4       | S       |
| 72 281.....  | 5 27.9                                       | 72 08     | .....        | A2          | 7.85         | 4       |         |
| 60 890.....  | 5 28.1                                       | 60 32     | .....        | Ao          | 8.17         | 3       |         |
| 69 339.....  | 5 29.0                                       | 69 55     | 7.04         | Ko          | 7.73         | 3       |         |
| 73 298.....  | 5 30.2                                       | 73 56     | 6.79         | Fo          | 6.94         | 3       |         |
| 71 314.....  | 5 30.3                                       | 71 35     | .....        | A2          | 7.96         | 5       |         |
| 61 806.....  | 5 31.2                                       | 61 53     | 6.65         | A5          | 6.93         | 4       |         |
| 62 775.....  | 5 32.2                                       | 62 34     | .....        | A5          | 8.16         | 3       |         |
| 63 599.....  | 5 32.3                                       | 63 14     | 7.18         | G5          | 8.05         | 6       |         |

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| B.D. No.     | R.A. 1900                        | Dec. 1900 | H.R.<br>Mag. | H.D.<br>Sp. | Ptg.<br>Mag. | No. Pl. | Remarks         |
|--------------|----------------------------------|-----------|--------------|-------------|--------------|---------|-----------------|
| 65° 485..... | 5 <sup>h</sup> 32 <sup>m</sup> 4 | 65° 38'   | 5.78         | Ko          | 6.82         | 3       |                 |
| 60 894.....  | 5 32.6                           | 60 34     | 6.98         | A3          | 7.08         | 5       | S               |
| 74 257.....  | 5 33.2                           | 74 34     | 7.27         | Go          | 7.80         | 2       |                 |
| 66 405.....  | 5 33.4                           | 66 28     | .....        | A2          | 8.24         | 3       |                 |
| 61 813.....  | 5 33.4                           | 61 35     | .....        | F5          | 8.14         | 4       |                 |
| 68 401.....  | 5 33.6                           | 68 49     | .....        | F5          | 8.12         | 3       |                 |
| 71 319.....  | 5 34.2                           | 71 53     | .....        | Fo          | 8.08         | 4       |                 |
| 67 396.....  | 5 34.3                           | 67 55     | .....        | Fo          | 7.96         | 5       |                 |
| 67 397.....  | 5 34.3                           | 67 15     | .....        | Fo          | 8.18         | 5       |                 |
| 60 897.....  | 5 34.5                           | 60 58     | .....        | F5          | 7.90         | 5       |                 |
| 62 779.....  | 5 34.6                           | 62 19     | .....        | F5          | 8.34         | 3       |                 |
| 61 816.....  | 5 34.9                           | 61 26     | 6.39         | G5          | 7.07         | 5       |                 |
| 64 544.....  | 5 36.4                           | 64 43     | 6.86         | Ko          | 8.12         | 4       |                 |
| 63 602.....  | 5 36.4                           | 63 15     | 7.57         | Fo          | 8.10         | 6       |                 |
| 63 604.....  | 5 37.9                           | 63 34     | 6.62         | G5          | 7.58         | 6       |                 |
| 62 784.....  | 5 39.6                           | 62 46     | 6.13         | A2          | 6.38         | 3       | S P.D.M. = 6.48 |
| 72 288.....  | 5 40.2                           | 72 27     | .....        | F8          | 8.03         | 3       |                 |
| 71 324.....  | 5 40.6                           | 71 15     | 7.17         | A3          | 7.17         | 4       | S               |
| 65 497.....  | 5 41.0                           | 64 44     | 6.65         | F8          | 7.21         | 2       |                 |
| 68 412.....  | 5 42.2                           | 68 26     | 6.40         | F5          | 8.12         | 3       |                 |
| 61 831.....  | 5 44.1                           | 61 39     | .....        | A2          | 7.64         | 5       |                 |
| 67 405.....  | 5 45.0                           | 67 32     | .....        | A3          | 8.10         | 3       |                 |
| 72 290.....  | 5 45.5                           | 72 38     | .....        | F2          | 7.50         | 3       |                 |
| 63 616.....  | 5 46.6                           | 63 16     | .....        | A5          | 7.85         | 3       |                 |
| 69 350.....  | 5 47.0                           | 69 35     | 7.04         | Fo          | 7.24         | 2       |                 |
| 66 413.....  | 5 47.5                           | 66 05     | 6.59         | Ko          | 7.65         | 2       |                 |
| 60 915.....  | 5 49.7                           | 60 22     | 7.01         | Fo          | 7.13         | 4       |                 |
| 66 419.....  | 5 50.4                           | 67 00     | 6.87         | Ao          | 6.91         | 4       | S               |
| 65 507.....  | 5 51.3                           | 65 31     | 6.74         | A3          | 6.68         | 3       | S               |
| 67 407.....  | 5 52.1                           | 67 19     | .....        | Ao          | 8.16         | 4       |                 |
| 65 509.....  | 5 52.2                           | 65 03     | 7.45         | Ko          | 8.26         | 5       |                 |
| 66 423.....  | 5 54.6                           | 66 58     | .....        | F5          | 7.97         | 4       |                 |
| 66 425.....  | 5 55.9                           | 66 17     | .....        | Ao          | 7.93         | 4       |                 |
| 65 510.....  | 5 56.1                           | 65 09     | 8.25         | F2          | 8.33         | 5       |                 |
| 64 564.....  | 5 56.5                           | 64 06     | .....        | F5          | 7.96         | 3       |                 |
| 65 511.....  | 5 57.1                           | 65 24     | 7.60         | A3          | 7.76         | 5       | S               |
| 63 330.....  | 5 57.1                           | 63 27     | 6.49         | Ko          | 7.48         | 3       |                 |
| 68 423.....  | 5 57.8                           | 68 44     | .....        | Ao          | 8.09         | 3       |                 |
| 62 811.....  | 5 58.7                           | 62 59     | .....        | A5          | 8.34         | 2       |                 |
| 62 813.....  | 5 58.9                           | 62 37     | .....        | Ao          | 8.03         | 4       |                 |
| 68 425.....  | 5 59.9                           | 68 26     | .....        | Fo          | 7.89         | 3       |                 |
| 71 340.....  | 6 0.3                            | 71 09     | 7.47         | F5          | 7.76         | 3       |                 |
| 62 818.....  | 6 1.6                            | 62 20     | .....        | B3          | 8.04         | 3       |                 |
| 60 931.....  | 6 2.2                            | 60 28     | 6.79         | Ma          | 8.24         | 4       |                 |
| 65 517.....  | 6 2.8                            | 65 44     | 5.39         | Ko          | 6.75         | 3       |                 |

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| 70° 395..... | 6 <sup>h</sup> 4 <sup>m</sup> 6 | 70° 49'   | 7.61      | G5       | 8.05      | 4       |             |
| 69 368.....  | 6 6.0                           | 69 30     | 7.56      | Ao       | 7.60      | 3       | S           |
| 60 938.....  | 6 6.7                           | 60 02     | 5.56      | Ko       | 6.72      | 4       |             |
| 65 519.....  | 6 7.1                           | 65 44     | .....     | K2       | 8.20      | 3       |             |
| 64 575.....  | 6 7.4                           | 64 52     | 7.55      | Ko       | 8.18      | 4       |             |
| 69 373.....  | 6 8.5                           | 69 52     | 6.83      | A5       | 6.81      | 4       | S           |
| 72 311.....  | 6 8.7                           | 72 11     | 6.80      | G5       | 7.88      | 3       |             |
| 61 869.....  | 6 8.7                           | 61 33     | 5.30      | Ma       | 6.92      | 4       |             |
| 68 436.....  | 6 8.8                           | 68 43     | 6.93      | Go       | 7.55      | 3       |             |
| 74 281.....  | 6 9.7                           | 74 54     | 7.87      | F8       | 7.94      | 2       |             |
| 71 350.....  | 6 9.9                           | 71 19     | .....     | Ao       | 8.17      | 3       |             |
| 61 878.....  | 6 12.9                          | 61 48     | 7.15      | Fo       | 7.41      | 4       |             |
| 60 951.....  | 6 13.0                          | 60 49     | 7.40      | A2       | 7.47      | 4       | S           |
| 64 580.....  | 6 14.0                          | 64 57     | 8.40      | F5       | 8.46      | 3       |             |
| 66 441.....  | 6 14.2                          | 66 34     | .....     | Fo       | 8.32      | 3       |             |
| 60 955.....  | 6 15.2                          | 60 08     | 7.26      | Ko       | 8.18      | 4       |             |
| 70 401.....  | 6 16.8                          | 70 35     | 5.99      | A2       | 6.14      | 5       | S           |
| 60 961.....  | 6 17.0                          | 60 51     | .....     | Ao       | 8.43      | 4       |             |
| 72 317.....  | 6 17.8                          | 72 05     | .....     | B9       | 7.91      | 6       |             |
| 70 402.....  | 6 18.8                          | 69 59     | 8.44      | Ao       | 8.29      | 3       |             |
| 60 971.....  | 6 21.4                          | 60 13     | 6.72      | B8       | 6.79      | 3       | S           |
| 60 974.....  | 6 23.4                          | 60 49     | .....     | Ao       | 8.49      | 2       |             |
| 65 533.....  | 6 24.3                          | 65 21     | 7.55      | F2       | 7.97      | 2       |             |
| 72 322.....  | 6 24.6                          | 72 06     | 7.79      | Go       | 8.14      | 5       |             |
| 75 258.....  | 6 25.0                          | 75 46     | 7.82      | F8       | 8.06      | 2       |             |
| 73 340.....  | 6 25.3                          | 73 46     | 6.22      | F2       | 6.36      | 3       |             |
| 70 406.....  | 6 25.5                          | 70 35     | 7.72      | A2       | 7.69      | 3       | S           |
| 71 358.....  | 6 27.5                          | 71 14     | .....     | Ao       | 8.08      | 5       |             |
| 74 393.....  | 6 28.2                          | 74 08     | .....     | F2       | 8.17      | 3       |             |
| 64 593.....  | 6 28.5                          | 64 49     | 7.45      | F5       | 8.05      | 3       |             |
| 61 893.....  | 6 28.6                          | 61 34     | 6.05      | Go       | 6.68      | 2       |             |
| 71 359.....  | 6 28.7                          | 71 50     | 6.07      | G5       | 7.01      | 4       |             |
| 66 455.....  | 6 29.4                          | 66 15     | 7.64      | B8       | 7.52      | 3       |             |
| 61 896.....  | 6 29.4                          | 61 34     | 7.02      | A3       | 6.94      | 2       |             |
| 61 895.....  | 6 29.4                          | 61 06     | .....     | Ao       | 8.31      | 2       |             |
| 67 441.....  | 6 29.8                          | 67 24     | .....     | B9       | 7.91      | 4       |             |
| 75 264.....  | 6 30.0                          | 75 09     | 8.02      | Fo       | 8.27      | 2       |             |
| 65 537.....  | 6 31.1                          | 65 04     | 7.55      | G5       | 8.38      | 3       |             |
| 62 867.....  | 6 31.3                          | 62 01     | 6.55      | A2       | 6.76      | 3       | P.D.M.=6.90 |
| 66 460.....  | 6 32.4                          | 66 17     | 7.12      | F8       | 7.57      | 3       |             |
| 66 463.....  | 6 34.0                          | 66 23     | .....     | F8       | 8.07      | 2       |             |
| 63 657.....  | 6 34.7                          | 63 04     | 6.86      | K2       | 8.14      | 2       |             |
| 69 389.....  | 6 36.4                          | 69 44     | 8.12      | Ao       | 8.01      | 4       |             |
| 62 874.....  | 6 36.4                          | 62 44     | .....     | B8       | 7.61      | 3       |             |
| 67 447.....  | 6 37.1                          | 66 59     | .....     | F8       | 8.34      | 2       |             |

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|--------------|----------------------------------|-----------|--------------|-------------|--------------|---------|---------|
| 63° 658..... | 6 <sup>h</sup> 38 <sup>m</sup> 1 | 63° 10'   | .....        | G5          | 8.41         | 2       |         |
| 67 454.....  | 6 40 5                           | 67 41     | 5.04         | B3          | 5.08         | 3       |         |
| 64 603.....  | 6 41 4                           | 69 28     | .....        | B9          | 8.20         | 3       |         |
| 63 353.....  | 6 42 7                           | 73 32     | .....        | A2          | 7.98         | 3       |         |
| 69 394.....  | 6 42 9                           | 69 00     | 5.13         | B5          | 5.26         | 3       | S       |
| 67 458.....  | 6 43 0                           | 67 20     | .....        | A2          | 8.26         | 3       |         |
| 68 454.....  | 6 44 1                           | 68 22     | .....        | F2          | 8.06         | 4       |         |
| 70 427.....  | 6 46 3                           | 70 13     | .....        | Ao          | 8.01         | 4       |         |
| 68 456.....  | 6 46 4                           | 68 19     | .....        | B9          | 8.15         | 5       |         |
| 68 458.....  | 6 48 4                           | 68 53     | 7.62         | F8          | 8.08         | 5       |         |
| 63 672.....  | 6 48 6                           | 63 00     | 7.48         | A5          | 7.67         | 3       | S       |
| 60 1015..... | 6 49.2                           | 60 55     | 7.62         | F8          | 7.83         | 3       |         |
| 70 430.....  | 6 50.0                           | 70 57     | 5.83         | Ko          | 7.04         | 4       |         |
| 67 406.....  | 6 50.0                           | 67 28     | 6.54         | G5          | 7.55         | 5       |         |
| 69 398.....  | 6 50.8                           | 69 47     | 6.74         | G5          | 7.63         | 4       |         |
| 71 378.....  | 6 52.0                           | 71 54     | .....        | F8          | 7.48         | 4       |         |
| 65 553.....  | 6 52.2                           | 65 54     | 7.62         | Ao          | 7.82         | 3       | S       |
| 63 378.....  | 6 52.5                           | 63 49     | 6.71         | K5          | 8.21         | 4       |         |
| 67 470.....  | 6 53.4                           | 67 36     | .....        | Go          | 8.31         | 3       |         |
| 69 402.....  | 6 53.7                           | 69 03     | .....        | F8          | 8.31         | 6       |         |
| 61 928.....  | 6 53.8                           | 61 27     | 7.72         | F2          | 8.04         | 4       |         |
| 70 432.....  | 6 54.6                           | 70 63     | 6.61         | Ko          | 8.05         | 4       |         |
| 64 616.....  | 6 57.0                           | 64 35     | .....        | F5          | 8.46         | 3       |         |
| 60 1027..... | 6 57.5                           | 60 17     | .....        | A2          | 8.16         | 4       |         |
| 66 480.....  | 6 58.8                           | 66 13     | .....        | A2          | 8.17         | 2       |         |
| 64 618.....  | 6 59.2                           | 64 31     | .....        | Ao          | 8.20         | 4       |         |
| 63 690.....  | 7 0.3                            | 63 02     | .....        | A5          | 8.46         | 2       |         |
| 72 350.....  | 7 0.6                            | 72 50     | 7.50         | Ao          | 7.54         | 2       | S       |
| 61 938.....  | 7 0.7                            | 60 57     | 6.73         | Ko          | 7.63         | 3       |         |
| 62 910.....  | 7 1.0                            | 62 17     | .....        | K5          | 8.22         | 3       |         |
| 60 1032..... | 7 1.3                            | 60 14     | .....        | F2          | 8.45         | 3       |         |
| 63 692.....  | 7 1.4                            | 63 28     | .....        | F5          | 8.16         | 4       |         |
| 72 352.....  | 7 2.3                            | 71 59     | 6.45         | Ko          | 7.48         | 2       |         |
| 60 1034..... | 7 2.6                            | 60 23     | 7.31         | Ko          | 8.15         | 3       |         |
| 62 913.....  | 7 3.3                            | 62 26     | .....        | B9          | 7.46         | 3       |         |
| 73 366.....  | 7 3.8                            | 73 29     | 7.70         | F8          | 8.03         | 2       |         |
| 61 948.....  | 7 5.7                            | 61 16     | .....        | F5          | 8.84         | 3       |         |
| 62 916.....  | 7 5.8                            | 62 19     | .....        | Go          | 8.34         | 2       |         |
| 65 562.....  | 7 6.4                            | 64 57     | 7.25         | F8          | 8.00         | 4       |         |
| 60 1039..... | 7 8.3                            | 60 06     | 7.86         | F5p         | 8.26         | 3       |         |
| 66 493.....  | 7 9.1                            | 66 55     | 7.62         | F8          | 8.15         | 4       |         |
| 68 472.....  | 7 10.0                           | 68 43     | 7.84         | A5          | 8.18         | 3       | S       |
| 61 959.....  | 7 12.9                           | 60 08     | .....        | Fo          | 8.43         | 4       |         |
| 60 1046..... | 7 13.1                           | 60 31     | .....        | F5          | 7.80         | 4       |         |
| 67 485.....  | 7 13.2                           | 68 26     | .....        | Go          | 8.28         | 3       |         |

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|--------------|----------------------------------|-----------|-----------|----------|-----------|---------|-----------------|
| 70° 449..... | 7 <sup>h</sup> 13 <sup>m</sup> 5 | 70° 53'   | 7.92      | Ao       | 8.00      | 3       | S               |
| 60 1048..... | 7 13.5                           | 60 05     | 6.28      | A5       | 6.63      | 4       | S P.D.M. = 6.64 |
| 74 322.....  | 7 13.6                           | 74 03     | 7.40      | Ao       | 7.42      | 3       | S               |
| 64 630.....  | 7 14.7                           | 64 19     | 7.34      | A2       | 7.65      | 4       | S               |
| 66 498.....  | 7 14.9                           | 66 00     | 7.33      | A5       | 7.81      | 3       |                 |
| 64 486.....  | 7 15.0                           | 67 19     | .....     | Ao       | 7.73      | 4       |                 |
| 61 963.....  | 7 15.0                           | 61 39     | .....     | A2       | 7.73      | 3       |                 |
| 74 324.....  | 7 16.5                           | 74 21     | .....     | A5       | 7.94      | 2       |                 |
| 66 502.....  | 7 17.5                           | 66 32     | 6.20      | B9       | 6.58      | 4       | S P.D.M. = 6.78 |
| 66 503.....  | 7 18.1                           | 66 42     | 7.52      | A5       | 7.94      | 4       | S P.D.M. = 8.08 |
| 68 480.....  | 7 20.5                           | 68 40     | 5.80      | Ko       | 6.98      | 3       |                 |
| 74 327.....  | 7 21.7                           | 74 33     | .....     | F2       | 8.30      | 2       |                 |
| 62 933.....  | 7 22.6                           | 62 43     | 6.77      | Ao       | 7.02      | 3       | S               |
| 71 405.....  | 7 22.9                           | 71 48     | 7.57      | A3       | 7.78      | 4       | S               |
| 62 934.....  | 7 23.1                           | 61 58     | 6.75      | G5       | 7.70      | 3       |                 |
| 73 381.....  | 7 26.4                           | 73 49     | 7.59      | F5       | 8.00      | 3       |                 |
| 65 579.....  | 7 27.0                           | 65 19     | 7.35      | Ko       | 8.27      | 4       |                 |
| 63 719.....  | 7 27.9                           | 63 34     | .....     | F2       | 7.82      | 2       |                 |
| 66 514.....  | 7 28.7                           | 66 26     | 7.07      | Ko       | 8.21      | 3       |                 |
| 60 1069..... | 7 28.8                           | 60 44     | 6.86      | Ao       | 6.94      | 2       | S               |
| 67 499.....  | 7 29.1                           | 67 16     | .....     | Fo       | 8.34      | 5       |                 |
| 61 983.....  | 7 29.2                           | 61 46     | 7.17      | F5       | 7.69      | 2       |                 |
| 66 517.....  | 7 30.2                           | 66 30     | .....     | Ao       | 8.26      | 3       |                 |
| 67 501.....  | 7 31.7                           | 67 47     | .....     | Go       | 8.45      | 2       |                 |
| 66 519.....  | 7 32.1                           | 66 27     | .....     | A2       | 8.29      | 3       |                 |
| 65 586.....  | 7 33.3                           | 65 31     | .....     | Fo       | 8.17      | 3       |                 |
| 65 585.....  | 7 33.3                           | 65 14     | .....     | F5       | 8.38      | 3       |                 |
| 67 506.....  | 7 35.8                           | 67 06     | .....     | A5       | 8.36      | 4       |                 |
| 65 591.....  | 7 36.3                           | 64 56     | 7.85      | F5       | 8.14      | 3       |                 |
| 65 592.....  | 7 36.4                           | 65 24     | 6.98      | F2       | 7.41      | 3       |                 |
| 69 438.....  | 7 36.6                           | 69 24     | 7.19      | Fo       | 7.31      | 3       |                 |
| 70 474.....  | 7 36.8                           | 70 27     | 7.14      | Go       | 7.80      | 4       |                 |
| 65 593.....  | 7 37.1                           | 65 42     | 6.00      | Ko       | 7.24      | 2       |                 |
| 63 733.....  | 7 37.4                           | 63 04     | 6.35      | A5       | 6.87      | 4       | S               |
| 64 649.....  | 7 37.7                           | 64 17     | 6.79      | A2       | 6.94      | 5       | S               |
| 60 1082..... | 7 39.3                           | 60 33     | 6.86      | F5       | 7.47      | 3       |                 |
| 64 651.....  | 7 39.6                           | 64 37     | 8.00      | F2       | 8.17      | 4       |                 |
| 60 1084..... | 7 41.5                           | 60 34     | 6.70      | A2       | 6.79      | 3       |                 |
| 64 654.....  | 7 42.1                           | 64 21     | .....     | Ko       | 8.25      | 4       |                 |
| 71 429.....  | 7 43.4                           | 71 20     | 7.17      | B8       | 7.25      | 4       | S               |
| 72 385.....  | 7 45.4                           | 72 06     | 7.24      | F5       | 7.64      | 3       |                 |
| 72 386.....  | 7 46.0                           | 71 56     | 7.52      | Ao       | 7.53      | 4       |                 |
| 63 743.....  | 7 46.3                           | 63 37     | .....     | F8       | 8.14      | 2       |                 |
| 62 960.....  | 7 46.7                           | 62 17     | 7.29      | G5       | 8.26      | 2       |                 |
| 74 338.....  | 7 48.2                           | 74 11     | 5.56      | Ko       | 6.94      | 2       |                 |

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|--------------|----------------------------------|-----------|--------------|-------------|--------------|---------|-----------------|
| 65 606.....  | 7 <sup>h</sup> 51 <sup>m</sup> 1 | 65° 01'   | 7.33         | Fo          | 7.41         | 4       | S               |
| 60 1105..... | 7 53.2                           | 60 36     | 6.00         | A2p         | 6.16         | 3       |                 |
| 61 1021..... | 7 53.6                           | 61 16     | 6.70         | F2          | 7.07         | 3       |                 |
| 65 607.....  | 7 53.9                           | 65 25     | 7.56         | F2          | 7.84         | 4       |                 |
| 60 1106..... | 7 54.0                           | 60 42     | .....        | Go          | 8.41         | 3       |                 |
| 62 970.....  | 7 54.4                           | 61 55     | 6.59         | Ao          | 6.69         | 3       | S               |
| 70 497.....  | 7 59.9                           | 70 00     | 6.55         | F8          | 7.09         | 4       |                 |
| 68 524.....  | 8 2.9                            | 68 46     | 5.48         | G5          | 6.47         | 3       |                 |
| 62 983.....  | 8 6.2                            | 62 20     | .....        | B9          | 8.51         | 2       |                 |
| 66 541.....  | 8 6.3                            | 66 29     | 7.02         | F2          | 7.57         | 5       |                 |
| 60 1117..... | 8 7.0                            | 60 19     | .....        | G5          | 8.18         | 2       | S               |
| 60 1119..... | 8 7.4                            | 60 41     | 6.36         | Fo          | 6.50         | 2       |                 |
| 64 674.....  | 8 7.5                            | 64 01     | .....        | F5          | 7.54         | 2       |                 |
| 61 1038..... | 8 9.8                            | 61 46     | .....        | Go          | 8.56         | 2       |                 |
| 63 770.....  | 8 9.9                            | 63 32     | .....        | Go          | 8.14         | 2       |                 |
| 60 1126..... | 8 10.5                           | 60 48     | .....        | Fo          | 7.23         | 2       | S               |
| 62 991.....  | 8 10.6                           | 62 49     | 5.77         | Go          | 6.69         | 2       |                 |
| 69 464.....  | 8 14.0                           | 69 14     | 7.16         | F5          | 7.52         | 3       |                 |
| 61 1043..... | 8 14.4                           | 60 57     | 6.48         | G5          | 7.33         | 3       |                 |
| 62 996.....  | 8 15.5                           | 62 37     | .....        | B9          | 7.57         | 3       |                 |
| 65 632.....  | 8 16.2                           | 65 03     | 7.50         | F5          | 7.80         | 3       | S P.D.M. = 5.74 |
| 60 1132..... | 8 17.7                           | 60 02     | 8.66         | Fo          | 8.65         | 3       |                 |
| 67 545.....  | 8 20.4                           | 67 38     | 6.01         | G5          | 6.79         | 4       |                 |
| 69 470.....  | 8 21.1                           | 68 52     | 6.89         | Bo          | 7.12         | 2       |                 |
| 60 1136..... | 8 22.9                           | 60 15     | 7.06         | F8          | 7.77         | 3       |                 |
| 69 472.....  | 8 23.0                           | 69 39     | 6.44         | Ko          | 7.79         | 4       | S P.D.M. = 5.74 |
| 65 638.....  | 8 25.6                           | 65 29     | 5.39         | Ao          | 5.58         | 3       |                 |
| 74 370.....  | 8 28.6                           | 73 59     | 6.29         | Ko          | 8.10         | 3       |                 |
| 65 643.....  | 8 30.3                           | 65 22     | .....        | Go          | 6.23         | 2       |                 |
| 60 1148..... | 8 31.0                           | 60 17     | 6.42         | Ao          | 6.29         | 3       |                 |
| 64 698.....  | 8 31.5                           | 64 40     | 4.76         | K2          | 5.98         | 4       | S               |
| 73 428.....  | 8 32.0                           | 73 31     | 6.93         | Ao          | 6.82         | 3       |                 |
| 61 1056..... | 8 32.6                           | 60 58     | .....        | Fo          | 8.21         | 3       |                 |
| 61 1070..... | 8 34.8                           | 61 17     | 7.46         | Ko          | 8.31         | 3       |                 |
| 73 430.....  | 8 35.1                           | 73 39     | 7.40         | A2          | 7.26         | 4       |                 |
| 72 427.....  | 8 36.7                           | 72 45     | 7.54         | F2          | 7.74         | 5       | S               |
| 66 575.....  | 8 38.9                           | 66 35     | .....        | F8          | 8.05         | 3       |                 |
| 67 560.....  | 8 39.8                           | 67 05     | 6.15         | B8          | 6.09         | 5       |                 |
| 64 707.....  | 8 41.1                           | 64 38     | 7.20         | Ko          | 8.46         | 2       |                 |
| 60 1078..... | 8 41.7                           | 61 36     | .....        | A2          | 7.74         | 2       |                 |
| 62 1027..... | 8 45.2                           | 62 20     | 5.72         | Fo          | 6.08         | 3       | S               |
| 71 482.....  | 8 46.0                           | 71 11     | .....        | K2          | 8.35         | 4       |                 |
| 65 673.....  | 8 48.1                           | 64 59     | 5.62         | G5          | 6.64         | 4       |                 |
| 66 587.....  | 8 48.2                           | 65 54     | 7.42         | G5          | 8.33         | 3       |                 |
| 61 1088..... | 8 49.6                           | 61 28     | .....        | A3          | 8.66         | 4       |                 |

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| 66° 589..... | 8 <sup>h</sup> 50 <sup>m</sup> 0 | 66° 23'   | 7.22         | Fo          | 7.60         | 6       |                 |
| 63 810.....  | 8 50.6                           | 63 50     | 7.07         | G5          | 8.18         | 4       |                 |
| 63 812.....  | 8 50.7                           | 63 44     | 6.94         | Fo          | 7.20         | 5       |                 |
| 62 1036..... | 8 52.1                           | 62 20     | .....        | Ko          | 8.57         | 4       |                 |
| 68 551.....  | 8 53.5                           | 68.01     | 4.99         | Ma          | 6.61         | 6       |                 |
| 71 486.....  | 8 54.1                           | 71 42     | 7.12         | Fo          | 7.27         | 6       |                 |
| 72 439.....  | 8 54.6                           | 72 07     | .....        | B9          | 8.47         | 2       |                 |
| 61 1098..... | 8 56.7                           | 61 23     | 7.72         | G5          | 7.76         | 4       |                 |
| 68 553.....  | 8 56.8                           | 68 30     | .....        | Ao          | 8.28         | 5       |                 |
| 69 504.....  | 8 57.3                           | 68 52     | 6.95         | A5          | 7.30         | 6       | S               |
| 72 441.....  | 8 59.2                           | 72 43     | .....        | F5          | 7.98         | 7       |                 |
| 67 573.....  | 8 59.6                           | 67 17     | 5.33         | K2          | 6.92         | 6       |                 |
| 67 577.....  | 9 1.6                            | 67 32     | 4.87         | F8          | 5.56         | 6       |                 |
| 68 557.....  | 9 2.2                            | 67 52     | .....        | F5          | 8.11         | 6       |                 |
| 69 509.....  | 9 2.3                            | 69 27     | .....        | A2          | 8.27         | 8       |                 |
| 63 825.....  | 9 3.3                            | 62 51     | .....        | A5          | 8.03         | 3       |                 |
| 72 444.....  | 9 4.3                            | 72 04     | 6.46         | Ko          | 7.50         | 8       |                 |
| 66 599.....  | 9 4.9                            | 66 08     | .....        | Fo          | 7.98         | 4       |                 |
| 66 600.....  | 9 5.2                            | 66 12     | .....        | F2          | 7.93         | 4       |                 |
| 73 452.....  | 9 5.8                            | 73 22     | 5.89         | A2          | 6.06         | 6       | S               |
| 62 1058..... | 9 6.4                            | 61 50     | 5.23         | F8          | 5.99         | 4       |                 |
| 67 581.....  | 9 6.6                            | 67 33     | .....        | Fo          | 7.55         | 6       |                 |
| 74 393.....  | 9 9.5                            | 74 26     | 6.54         | G5          | 7.55         | 5       |                 |
| 60 1181..... | 9 12.9                           | 60 12     | 7.46         | Ko          | 8.67         | 4       |                 |
| 61 1114..... | 9 13.0                           | 61 48     | 7.58         | A5          | 7.96         | 2       |                 |
| 61 1118..... | 9 16.6                           | 60 52     | 7.48         | K2          | 8.80         | 3       |                 |
| 60 1187..... | 9 17.4                           | 60 26     | .....        | Go          | 7.90         | 2       |                 |
| 64 733.....  | 9 17.7                           | 64 23     | 6.46         | K2          | 7.96         | 4       |                 |
| 64 735.....  | 9 18.9                           | 64 47     | 8.25         | A2          | 8.56         | 3       |                 |
| 68 572.....  | 9 22.7                           | 67 58     | 7.22         | A2          | 7.50         | 5       | S P.D.M. = 7.73 |
| 67 594.....  | 9 23.3                           | 67 19     | 8.02         | Fo          | 8.19         | 4       |                 |
| 72 462.....  | 9 25.4                           | 72 39     | 5.82         | F5          | 6.24         | 8       |                 |
| 70 505.....  | 9 25.6                           | 70 16     | 4.57         | Go          | 5.58         | 9       |                 |
| 67 597.....  | 9 26.0                           | 67 14     | 7.37         | F5          | 7.79         | 5       |                 |
| 74 402.....  | 9 26.2                           | 74 47     | 6.38         | B9          | 6.19         | 4       | S               |
| 61 1132..... | 9 27.7                           | 61 20     | 7.17         | Fo          | 7.63         | 4       |                 |
| 72 464.....  | 9 27.9                           | 72 32     | 7.24         | F5          | 7.89         | 8       |                 |
| 70 467.....  | 9 28.0                           | 70 05     | 7.12         | Fo          | 7.46         | 9       |                 |
| 73 470.....  | 9 28.4                           | 73 32     | 6.43         | Fo          | 6.64         | 8       |                 |
| 61 1134..... | 9 28.5                           | 61 40     | .....        | F5          | 8.79         | 4       |                 |
| 70 568.....  | 9 29.5                           | 70 43     | 6.84         | F2          | 7.40         | 7       |                 |
| 73 471.....  | 9 30.1                           | 73 11     | 6.98         | A3          | 7.20         | 8       |                 |
| 60 1198..... | 9 30.2                           | 60 39     | 6.56         | G5          | 7.44         | 4       |                 |
| 69 526.....  | 9 30.3                           | 69 45     | 8.04         | Fo          | 8.34         | 6       |                 |
| 67 602.....  | 9 31.2                           | 67 43     | 6.28         | K5          | 7.71         | 6       |                 |

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| 72° 465..... | 9 <sup>h</sup> 31 <sup>m</sup> 6 | 72° 12'   | .....        | F5          | 7.98         | 10      |               |
| 69 531.....  | 9 33.7                           | 69 42     | 5.74         | Ko          | 7.97         | 7       |               |
| 67 608.....  | 9 33.7                           | 67 12     | .....        | A2          | 8.30         | 5       |               |
| 72 466.....  | 9 33.8                           | 72 42     | 5.39         | Ko          | 6.22         | 9       |               |
| 63 858.....  | 9 35.6                           | 63 23     | 7.87         | A3          | 8.21         | 3       | S P.D.M.=8.39 |
| 65 731.....  | 9 36.8                           | 65 26     | 6.18         | F2          | 6.43         | 3       |               |
| 64 752.....  | 9 38.2                           | 64 07     | 6.50         | F2          | 6.70         | 2       |               |
| 63 861.....  | 9 40.0                           | 63 43     | 6.94         | G5          | 8.05         | 2       |               |
| 65 736.....  | 9 41.0                           | 65 22     | 8.08         | F5          | 7.43         | 3       |               |
| 60 1209..... | 9 41.6                           | 60 34     | 7.24         | Ko          | 8.52         | 3       |               |
| 67 617.....  | 9 41.9                           | 67 02     | .....        | F2          | 8.18         | 2       |               |
| 66 637.....  | 9 42.6                           | 66 04     | 6.29         | Fo          | 6.38         | 3       |               |
| 72 473.....  | 9 45.3                           | 72 09     | 7.58         | Ao          | 7.74         | 10      | S             |
| 61 1151..... | 9 47.8                           | 61 36     | 6.42         | Ko          | 7.68         | 2       |               |
| 73 478.....  | 9 49.5                           | 73 21     | 5.96         | Ko          | 7.06         | 8       |               |
| 69 550.....  | 9 53.6                           | 69 12     | .....        | Fo          | 8.34         | 6       |               |
| 69 552.....  | 9 55.0                           | 69 10     | .....        | F5          | 8.32         | 7       |               |
| 63 882.....  | 9 56.2                           | 63 03     | 7.44         | Ko          | 7.55         | 2       |               |
| 64 764.....  | 9 56.3                           | 64 35     | .....        | F2          | 8.58         | 2       |               |
| 67 632.....  | 9 57.4                           | 67 40     | 7.11         | Ko          | 8.21         | 5       |               |
| 60 1234..... | 9 57.6                           | 60 00     | .....        | A3          | 8.56         | 3       |               |
| 65 749.....  | 9 58.4                           | 64 54     | 7.65         | F2          | 8.05         | 4       |               |
| 66 648.....  | 9 59.2                           | 65 48     | .....        | F5          | 8.37         | 3       |               |
| 70 598.....  | 9 59.9                           | 70 25     | 7.90         | Fo          | 8.25         | 5       |               |
| 67 635.....  | 10 0.4                           | 67 20     | .....        | Go          | 8.28         | 3       |               |
| 69 561.....  | 10 1.7                           | 69 10     | 7.26         | Ko          | 8.16         | 5       |               |
| 64 770.....  | 10 1.9                           | 64 26     | 6.75         | K5          | 8.39         | 2       |               |
| 74 427.....  | 10 2.7                           | 74 22     | 7.67         | A2          | 7.80         | 6       |               |
| 71 529.....  | 10 3.0                           | 71 21     | 7.59         | Ko          | 8.46         | 6       |               |
| 63 886.....  | 10 3.2                           | 63 25     | 7.12         | Ko          | 8.22         | 2       |               |
| 60 1250..... | 10 9.2                           | 60 39     | 6.75         | F2          | 7.32         | 3       |               |
| 73 489.....  | 10 9.6                           | 73 35     | 6.48         | Fo          | 6.70         | 7       |               |
| 65 767.....  | 10 10.8                          | 65 36     | 5.74         | A3          | 5.86         | 3       | S             |
| 73 491.....  | 10 10.9                          | 72 57     | .....        | Ko          | 8.14         | 8       |               |
| 69 568.....  | 10 13.4                          | 69 15     | 5.84         | Fo          | 6.09         | 9       |               |
| 61 1183..... | 10 14.9                          | 61 24     | 7.47         | Ko          | 8.76         | 2       |               |
| 66 664.....  | 10 16.9                          | 66 04     | 4.92         | Ao          | 4.86         | 2       | S             |
| 60 1203..... | 10 21.1                          | 60 05     | 7.01         | Ko          | 8.15         | 2       |               |
| 66 671.....  | 10 22.8                          | 66 08     | 6.39         | Ko          | 7.60         | 3       |               |
| 74 436.....  | 10 23.2                          | 73 50     | 7.14         | Ko          | 8.22         | 5       |               |
| 64 789.....  | 10 23.6                          | 64 45     | 6.00         | A3          | 6.25         | 3       | S P.D.M.=6.44 |
| 74 437.....  | 10 23.7                          | 74 18     | 8.07         | Ao          | 8.28         | 5       |               |
| 67 658.....  | 10 24.2                          | 66 49     | 7.27         | F2          | 7.63         | 4       |               |
| 74 438.....  | 10 26.1                          | 74 21     | 7.52         | A3          | 7.61         | 6       | S             |
| 68 611.....  | 10 27.1                          | 68 03     | .....        | Fo          | 8.27         | 2       |               |

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| 69° 576..... | 10 <sup>h</sup> 27 <sup>m</sup> 5 | 69° 22'   | .....     | A5       | 8.42      | 5       |               |
| 64 795.....  | 10 29.2                           | 64 07     | .....     | F2       | 8.32      | 2       |               |
| 60 1274..... | 10 31.8                           | 60 38     | 6.87      | F8       | 7.39      | 3       |               |
| 70 620.....  | 10 32.5                           | 70 40     | .....     | F8       | 8.46      | 6       |               |
| 74 440.....  | 10 33.2                           | 74 18     | 7.67      | F5       | 8.00      | 6       |               |
| 69 583.....  | 10 34.7                           | 68 58     | 5.90      | Ko       | 7.21      | 9       |               |
| 66 678.....  | 10 35.2                           | 66 14     | 5.12      | Ko       | 6.49      | 3       |               |
| 69 584.....  | 10 35.4                           | 69 08     | 8.08      | A3       | 8.38      | 5       |               |
| 69 586.....  | 10 35.9                           | 69 36     | 5.23      | Ko       | 6.42      | 9       |               |
| 66 682.....  | 10 41.1                           | 65 59     | 7.58      | F8       | 8.20      | 3       |               |
| 60 1280..... | 10 41.1                           | 60 38     | 7.22      | Fo       | 7.50      | 2       |               |
| 65 803.....  | 10 42.1                           | 65 40     | 6.24      | B9       | 6.36      | 3       | S             |
| 64 810.....  | 10 42.9                           | 64 19     | 6.58      | Ko       | 7.78      | 2       |               |
| 70 634.....  | 10 46.8                           | 70 23     | 6.08      | G5       | 6.94      | 10      |               |
| 64 814.....  | 10 47.1                           | 64 05     | .....     | Go       | 8.44      | 2       |               |
| 70 640.....  | 10 51.9                           | 70 21     | 8.01      | Fo       | 8.21      | 8       |               |
| 64 824.....  | 10 54.8                           | 63 58     | 6.34      | Ao       | 6.43      | 4       | S             |
| 71 557.....  | 10 55.7                           | 70 56     | .....     | A2       | 8.34      | 6       |               |
| 74 452.....  | 10 55.8                           | 74 11     | .....     | F8       | 8.41      | 4       |               |
| 70 645.....  | 10 56.8                           | 70 35     | 6.64      | Ko       | 7.84      | 7       |               |
| 62 1160..... | 10 57.2                           | 62 12     | 7.12      | F8       | 7.37      | 3       |               |
| 65 817.....  | 10 59.3                           | 65 21     | 7.22      | Fo       | 7.69      | 5       |               |
| 66 697.....  | 10 59.8                           | 66 25     | 7.67      | G5       | 8.36      | 2       |               |
| 72 515.....  | 11 1.6                            | 72 28     | 6.87      | Fo       | 8.31      | 7       |               |
| 68 632.....  | 11 3.3                            | 67 45     | 6.09      | A5       | 6.30      | 7       | S P.D.M.=6.37 |
| 67 684.....  | 11 3.6                            | 67 17     | .....     | Fo       | 8.24      | 5       |               |
| 64 834.....  | 11 3.6                            | 63 51     | 7.87      | F5       | 8.29      | 3       |               |
| 69 602.....  | 11 5.8                            | 68 50     | 6.42      | A2       | 6.50      | 7       |               |
| 61 1226..... | 11 6.2                            | 61 44     | .....     | A2       | 7.37      | 3       | S             |
| 67 686.....  | 11 6.5                            | 67 33     | .....     | F2       | 8.36      | 3       |               |
| 68 635.....  | 11 6.9                            | 67 52     | .....     | G5       | 7.62      | 9       |               |
| 63 947.....  | 11 8.0                            | 62 48     | 7.77      | G5       | 8.51      | 2       |               |
| 72 526.....  | 11 8.4                            | 72 33     | 7.34      | B9       | 7.60      | 8       | S             |
| 74 456.....  | 11 8.7                            | 74 01     | 7.18      | K5       | 8.18      | 5       |               |
| 65 823.....  | 11 9.9                            | 65 27     | 7.07      | Ko       | 8.21      | 5       |               |
| 70 654.....  | 11 10.3                           | 69 45     | 8.14      | Go       | 8.42      | 3       |               |
| 60 1318..... | 11 10.4                           | 60 28     | 6.66      | A3       | 6.97      | 4       |               |
| 68 630.....  | 11 11.5                           | 68 25     | .....     | F2       | 8.32      | 6       |               |
| 61 1235..... | 11 11.6                           | 60 49     | 6.74      | Ko       | 7.71      | 4       |               |
| 67 691.....  | 11 12.7                           | 67 13     | 7.12      | Fo       | 7.33      | 8       |               |
| 64 841.....  | 11 12.9                           | 64 03     | .....     | F2       | 8.32      | 4       |               |
| 62 1172..... | 11 13.1                           | 62 43     | 7.02      | Ko       | 8.09      | 4       |               |
| 63 952.....  | 11 14.7                           | 62 54     | .....     | F2       | 8.16      | 4       |               |
| 67 692.....  | 11 14.8                           | 67 38     | 6.31      | Ko       | 7.32      | 8       |               |
| 65 828.....  | 11 16.9                           | 64 53     | 5.98      | Ao       | 6.00      | 7       | S             |

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| 63° 957..... | II 17 <sup>m</sup> 4 | 63° 14'   | .....        | Fo          | 8.18         | 4       |         |
| 65 830.....  | II 18.4              | 65 36     | .....        | F8          | 7.80         | 5       |         |
| 67 699.....  | II 20.8              | 67 26     | .....        | F5          | 8.32         | 6       |         |
| 69 608.....  | II 21.6              | 68 59     | .....        | A2          | 8.25         | 4       |         |
| 64 848.....  | II 23.2              | 64 07     | 7.62         | F5          | 8.04         | 3       |         |
| 68 644.....  | II 23.3              | 67 59     | 7.27         | Ko          | 8.28         | 5       |         |
| 62 1183..... | II 23.4              | 62 19     | 5.86         | Fo          | 6.08         | 3       |         |
| 67 701.....  | II 23.5              | 67 29     | 7.49         | F2          | 7.81         | 8       |         |
| 68 645.....  | II 24.2              | 68 41     | .....        | A2          | 8.21         | 2       |         |
| 70 665.....  | II 25.5              | 69 53     | 4.06         | Ma          | 5.78         | 5       |         |
| 61 1246..... | II 26.7              | 61 38     | 5.47         | F5          | 5.88         | 4       |         |
| 68 650.....  | II 28.3              | 68 08     | .....        | A5          | 8.22         | 5       |         |
| 66 724.....  | II 28.4              | 65 48     | 7.22         | F8          | 7.80         | 5       |         |
| 74 464.....  | II 21.1              | 73 57     | .....        | F5          | 8.45         | 2       |         |
| 70 670.....  | II 30.2              | 69 53     | 5.36         | G5          | 6.33         | 9       |         |
| 67 709.....  | II 30.5              | 66 54     | .....        | F5          | 8.08         | 6       |         |
| 63 972.....  | II 32.1              | 63 15     | 7.32         | F2          | 7.50         | 4       |         |
| 64 857.....  | II 32.8              | 64 43     | 7.85         | Ao          | 7.66         | 6       |         |
| 65 843.....  | II 33.3              | 64 53     | 6.44         | A2          | 6.47         | 6       | S       |
| 69 618.....  | II 33.6              | 69 24     | .....        | F5          | 8.46         | 6       |         |
| 63 974.....  | II 34.8              | 62 57     | 7.02         | F5          | 7.53         | 3       |         |
| 60 1339..... | II 35.3              | 60 39     | 7.79         | Fo          | 7.94         | 4       |         |
| 61 1258..... | II 35.6              | 61 24     | 7.17         | G5          | 7.71         | 4       |         |
| 67 714.....  | II 36.9              | 67 18     | 5.48         | K2          | 6.66         | 8       |         |
| 73 532.....  | II 38.9              | 73 42     | 7.24         | K2          | 8.42         | 2       |         |
| 70 674.....  | II 39.5              | 70 29     | 7.62         | A2          | 7.78         | 7       | S       |
| 65 851.....  | II 41.6              | 64 57     | 7.45         | Ao          | 7.55         | 6       | S       |
| 62 1198..... | II 41.7              | 61 58     | 6.64         | Fo          | 7.08         | 4       |         |
| 68 662.....  | II 43.7              | 67 53     | 7.17         | F8          | 7.62         | 7       |         |
| 69 628.....  | II 45.9              | 69 24     | 7.09         | A2          | 7.33         | 10      |         |
| 63 982.....  | II 47.8              | 63 19     | .....        | A2          | 8.32         | 2       |         |
| 74 475.....  | II 47.9              | 73 51     | 7.64         | Ko          | 8.36         | 2       |         |
| 74 476.....  | II 48.3              | 74 19     | 6.78         | F8          | 7.26         | 6       |         |
| 72 550.....  | II 48.8              | 72 28     | 7.54         | F5          | 8.00         | 9       |         |
| 72 551.....  | II 49.0              | 72 42     | .....        | A3          | 8.30         | 7       |         |
| 73 537.....  | II 49.8              | 72 57     | .....        | F5          | 8.42         | 3       |         |
| 68 665.....  | II 50.3              | 67 49     | 7.47         | Go          | 7.76         | 8       |         |
| 66 737.....  | II 51.4              | 65 47     | 6.72         | G5          | 7.56         | 5       |         |
| 62 1204..... | II 51.7              | 62 06     | 6.28         | G5          | 7.10         | 4       |         |
| 63 987.....  | II 52.1              | 62 47     | .....        | F5          | 8.33         | 3       |         |
| 68 667.....  | II 52.8              | 68 22     | 7.07         | K2          | 8.16         | 7       |         |
| 62 1206..... | II 53.1              | 62 02     | 6.66         | G5          | 7.70         | 4       |         |
| 62 1207..... | II 54.1              | 61 53     | 7.52         | A3          | 7.55         | 4       |         |
| 72 554.....  | II 54.4              | 72 08     | .....        | F5          | 8.36         | 2       |         |
| 69 636.....  | II 55.5              | 69 45     | 7.32         | Fo          | 7.71         | 8       |         |

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| B.D. No.     | R.A. 1900                         | Dec. 1900 | H.R. Mag. | H.D. Sp. | Ptg. Mag. | No. Pl. | Remarks |
|--------------|-----------------------------------|-----------|-----------|----------|-----------|---------|---------|
| 71° 598..... | 11 <sup>h</sup> 55 <sup>m</sup> 7 | 70° 47'   | 6.69      | Ao       | 6.78      | 10      | S       |
| 71 599.....  | 11 56.5                           | 71 25     | 7.36      | Ko       | 8.28      | 3       |         |
| 65 853.....  | 11 56.5                           | 65 30     | 7.25      | A3       | 7.36      | 5       | S       |
| 69 638.....  | 11 58.5                           | 69 35     | 7.10      | K2       | 8.39      | 6       |         |
| 67 730.....  | 11 59.5                           | 66 54     | 7.87      | F8       | 8.21      | 6       |         |
| 69 642.....  | 12 0.5                            | 69 18     | 8.07      | Ma       | 8.1-8.6   | 8       | Var.    |
| 63 999.....  | 12 0.6                            | 63 30     | 6.24      | Ko       | 7.46      | 4       |         |
| 69 644.....  | 12 1.1                            | 69 15     | 7.14      | F5       | 7.48      | 8       |         |
| 69 645.....  | 12 2.3                            | 69 38     | 7.91      | G5       | 8.40      | 3       |         |
| 72 558.....  | 12 3.0                            | 72 19     | .....     | A2       | 8.30      | 7       |         |
| 66 746.....  | 12 3.6                            | 65 54     | .....     | F8       | 8.17      | 5       |         |
| 75 469.....  | 12 4.9                            | 75 13     | 6.36      | F5       | 6.81      | 4       |         |
| 67 735.....  | 12 8.2                            | 67 38     | .....     | F8       | 8.38      | 2       |         |
| 61 1283..... | 12 8.2                            | 60 57     | .....     | A2       | 8.41      | 4       |         |
| 66 751.....  | 12 9.2                            | 66 40     | 6.78      | Ko       | 8.07      | 6       |         |
| 71 610.....  | 12 10.4                           | 70 45     | 5.89      | Ko       | 7.00      | 10      |         |
| 73 549.....  | 12 11.0                           | 73 07     | 6.55      | Ko       | 7.57      | 8       |         |
| 64 887.....  | 12 11.9                           | 64 11     | .....     | F8       | 8.47      | 3       |         |
| 61 1289..... | 12 13.5                           | 60 53     | .....     | G5       | 8.46      | 5       |         |
| 75 470.....  | 12 14.4                           | 75 43     | 5.41      | A2       | 5.53      | 4       | S       |
| 63 1009..... | 12 14.9                           | 62 55     | 7.72      | A3       | 7.91      | 5       | S       |
| 67 742.....  | 12 15.6                           | 66 57     | 7.12      | Ao       | 6.99      | 8       | S       |
| 64 890.....  | 12 15.8                           | 64 14     | 7.37      | G5       | 8.12      | 5       |         |
| 62 1228..... | 12 17.3                           | 62 09     | 6.86      | G5       | 7.79      | 4       |         |
| 61 1292..... | 12 18.9                           | 61 28     | 7.69      | G5       | 8.36      | 4       |         |
| 61 1294..... | 12 20.3                           | 61 14     | 7.41      | Go       | 7.68      | 5       |         |
| 64 896.....  | 12 20.4                           | 64 22     | 6.37      | G5       | 7.24      | 5       |         |
| 72 505.....  | 12 22.1                           | 72 29     | 6.44      | Ko       | 7.48      | 10      |         |
| 61 1295..... | 12 22.9                           | 61 42     | 7.85      | A2       | 7.90      | 5       | S       |
| 66 761.....  | 12 23.8                           | 66 02     | 8.08      | F2       | 8.19      | 3       |         |
| 67 746.....  | 12 24.8                           | 67 27     | 7.02      | G5       | 7.96      | 8       |         |
| 70 700.....  | 12 25.7                           | 69 45     | 5.25      | Ma       | 6.78      | 10      |         |
| 66 763.....  | 12 26.4                           | 66 27     | 6.72      | A3       | 6.96      | 8       | S       |
| 72 569.....  | 12 26.7                           | 71 52     | 7.02      | Ko       | 8.04      | 10      |         |
| 69 666.....  | 12 27.5                           | 69 03     | 7.42      | F5       | 7.80      | 7       |         |
| 72 570.....  | 12 27.7                           | 72 44     | .....     | A2       | 8.06      | 8       |         |
| 73 559.....  | 12 29.4                           | 73 02     | 7.37      | F8       | 7.91      | 8       |         |
| 70 705.....  | 12 30.5                           | 70 34     | 5.18      | Ko       | 6.30      | 9       |         |
| 69 669.....  | 12 31.6                           | 69 34     | 7.42      | G5       | 8.02      | 7       |         |
| 70 707.....  | 12 32.7                           | 70 44     | 6.72      | K2       | 8.14      | 5       |         |
| 72 575.....  | 12 34.3                           | 72 41     | .....     | Ao       | 8.08      | 6       |         |
| 61 1309..... | 12 35.1                           | 61 26     | 7.10      | Ko       | 7.99      | 6       |         |
| 73 561.....  | 12 35.6                           | 73 33     | 7.44      | Ko       | 8.11      | 6       |         |
| 60 1416..... | 12 35.9                           | 60 05     | 7.87      | A3       | 7.98      | 4       |         |
| 69 671.....  | 12 36.1                           | 69 20     | .....     | F8       | 8.56      | 5       |         |

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| 64° 914..... | 12 <sup>h</sup> 36 <sup>m</sup> 4 | 64° 19'   | 7.50      | F5       | 7.82      | 5       |                 |
| 63 1026..... | 12 37.2                           | 63 16     | 5.92      | Ao       | 5.82      | 5       | S               |
| 61 1312..... | 12 38.7                           | 61 42     | 6.46      | Ko       | 7.59      | 5       |                 |
| 66 768.....  | 12 39.1                           | 66 29     | 7.48      | F2       | 7.88      | 4       |                 |
| 72 578.....  | 12 40.1                           | 72 37     | .....     | A3       | 8.10      | 6       |                 |
| 72 579.....  | 12 40.8                           | 72 39     | .....     | Ko       | 8.22      | 4       |                 |
| 63 1034..... | 12 43.0                           | 63 20     | 5.83      | A5       | 5.96      | 4       | S               |
| 67 764.....  | 12 43.5                           | 67 20     | 5.67      | K5       | 7.05      | 8       |                 |
| 71 630.....  | 12 44.1                           | 71 29     | 7.32      | K5       | 8.27      | 4       |                 |
| 61 1320..... | 12 44.3                           | 60 52     | 5.87      | F5       | 6.08      | 4       |                 |
| 62 1257..... | 12 44.7                           | 61 55     | 7.32      | Go       | 7.80      | 4       |                 |
| 65 903.....  | 12 44.8                           | 65 17     | .....     | Fo       | 7.92      | 6       |                 |
| 63 1037..... | 12 46.7                           | 63 31     | 7.16      | A3       | 7.64      | 3       | S P.D.M. = 7.57 |
| 70 715.....  | 12 47.4                           | 69 50     | 7.94      | Ao       | 7.97      | 9       |                 |
| 72 588.....  | 12 49.1                           | 72 06     | .....     | A5       | 7.98      | 8       |                 |
| 60 1426..... | 12 49.4                           | 60 03     | .....     | Fo       | 8.02      | 4       |                 |
| 66 778.....  | 12 51.5                           | 65 59     | 5.27      | Fo       | 5.48      | 6       |                 |
| 69 677.....  | 12 52.9                           | 69 08     | 7.38      | G5       | 8.34      | 6       |                 |
| 68 703.....  | 12 53.1                           | 67 47     | 6.66      | Ko       | 8.09      | 7       |                 |
| 71 636.....  | 12 53.6                           | 71 18     | .....     | Fo       | 7.04      | 8       |                 |
| 65 913.....  | 12 54.4                           | 65 27     | 6.56      | Ko       | 7.75      | 6       |                 |
| 69 680.....  | 12 54.5                           | 69 14     | 7.42      | G5       | 8.40      | 5       |                 |
| 69 681.....  | 12 55.3                           | 69 19     | .....     | Go       | 8.52      | 3       |                 |
| 71 638.....  | 12 55.5                           | 71 08     | 7.12      | K2       | 8.30      | 8       |                 |
| 67 773.....  | 12 56.2                           | 68 08     | 5.50      | Ko       | 6.05      | 8       |                 |
| 64 927.....  | 12 57.9                           | 64 09     | 6.02      | F5       | 6.35      | 4       | S               |
| 60 1439..... | 12 58.6                           | 60 16     | 6.33      | Ao       | 6.39      | 4       |                 |
| 72 599.....  | 12 59.7                           | 72 15     | .....     | Fo       | 7.92      | 8       |                 |
| 73 581.....  | 13 0.8                            | 72 56     | .....     | Ao       | 8.00      | 7       |                 |
| 62 1274..... | 13 1.5                            | 62 36     | .....     | A2       | 8.55      | 3       |                 |
| 62 1275..... | 13 2.4                            | 62 35     | 6.31      | Ko       | 7.22      | 5       |                 |
| 63 1053..... | 13 4.3                            | 63 14     | .....     | Ko       | 8.73      | 2       |                 |
| 74 521.....  | 13 5.1                            | 73 53     | .....     | Ao       | 7.72      | 7       | S               |
| 63 1056..... | 13 5.9                            | 62 47     | 6.49      | Ao       | 6.45      | 4       |                 |
| 66 796.....  | 13 7.0                            | 66 06     | .....     | A3       | 8.17      | 2       |                 |
| 63 1057..... | 13 7.6                            | 63 42     | 7.48      | F5       | 8.06      | 4       |                 |
| 68 717.....  | 13 9.6                            | 67 52     | 7.04      | Ko       | 8.20      | 7       |                 |
| 68 720.....  | 12 10.1                           | 67 49     | 6.75      | Ko       | 7.58      | 6       |                 |
| 73 587.....  | 13 10.7                           | 73 20     | 6.43      | Ao       | 6.52      | 6       | S               |
| 64 938.....  | 13 12.3                           | 64 10     | .....     | F5       | 8.42      | 2       |                 |
| 69 694.....  | 13 13.2                           | 68 56     | 6.11      | B9       | 6.05      | 6       | S               |
| 72 608.....  | 13 14.7                           | 71 46     | .....     | F8       | 8.16      | 8       |                 |
| 68 723.....  | 13 14.9                           | 68 13     | 7.32      | Ko       | 8.34      | 2       |                 |
| 67 780.....  | 13 15.6                           | 67 44     | .....     | F5       | 8.24      | 3       |                 |
| 60 1458..... | 13 16.3                           | 60 23     | .....     | F8       | 8.34      | 4       |                 |

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|---------------|-----------------------------------|-----------|--------------|-------------|--------------|---------|---------|
| 61° 1350..... | 13 <sup>h</sup> 16 <sup>m</sup> 4 | 60° 56'   | .....        | G5          | 8.27         | 4       |         |
| 62 1288.....  | 13 16.7                           | 61 56     | 8.03         | A2          | 8.15         | 3       |         |
| 70 736.....   | 13 17.3                           | 70 10     | 7.99         | F5          | 8.38         | 6       |         |
| 69 696.....   | 13 17.6                           | 69 38     | 7.24         | G5          | 8.18         | 7       |         |
| 63 1071.....  | 13 19.9                           | 63 19     | 7.98         | G0          | 8.45         | 3       |         |
| 64 949.....   | 13 22.6                           | 63 46     | 6.55         | G5          | 7.33         | 5       |         |
| 73 592.....   | 13 23.6                           | 72 55     | 6.07         | K5          | 7.61         | 6       |         |
| 71 651.....   | 13 24.4                           | 76 51     | 7.46         | F0          | 7.68         | 5       |         |
| 60 1461.....  | 13 24.8                           | 60 28     | 5.41         | A0          | 5.36         | 4       |         |
| 70 741.....   | 13 25.3                           | 70 38     | 7.52         | K0          | 8.24         | 5       |         |
| 64 951.....   | 13 26.5                           | 64 42     | 7.05         | G0          | 7.94         | 4       |         |
| 71 654.....   | 13 28.8                           | 70 56     | 7.84         | A5          | 8.17         | 6       |         |
| 61 1366.....  | 13 30.2                           | 60 46     | 6.95         | K0          | 7.95         | 3       |         |
| 65 946.....   | 13 31.6                           | 65 46     | .....        | F2          | 8.38         | 6       |         |
| 70 747.....   | 13 32.4                           | 70 37     | 7.31         | A0          | 7.41         | 7       |         |
| 67 790.....   | 13 34.0                           | 67 33     | 6.80         | G5          | 7.84         | 7       |         |
| 71 659.....   | 13 34.8                           | 71 45     | 5.67         | K0          | 6.69         | 8       |         |
| 67 792.....   | 13 35.1                           | 67 07     | 7.79         | A2          | 7.98         | 6       |         |
| 64 961.....   | 13 37.9                           | 64 22     | .....        | F5          | 8.54         | 3       |         |
| 65 953.....   | 13 38.4                           | 65 20     | 5.70         | A0          | 5.85         | 5       |         |
| 66 816.....   | 13 39.0                           | 65 47     | 6.55         | A2          | 6.69         | 5       |         |
| 60 1485.....  | 13 40.5                           | 60 39     | 7.06         | A0          | 7.15         | 6       |         |
| 65 957.....   | 13 41.2                           | 65 31     | .....        | F5          | 8.29         | 4       |         |
| 69 716.....   | 13 41.9                           | 69 43     | 8.14         | F5          | 8.54         | 7       |         |
| 65 961.....   | 13 42.5                           | 65 07     | 7.80         | A2          | 8.12         | 7       |         |
| 69 717.....   | 13 42.7                           | 69 30     | 7.89         | F8          | 8.32         | 6       |         |
| 62 1318.....  | 13 46.5                           | 61 59     | 6.05         | K0          | 6.87         | 5       |         |
| 61 1381.....  | 13 46.8                           | 61 02     | 7.70         | A0          | 7.88         | 5       |         |
| 72 628.....   | 13 47.4                           | 72 36     | .....        | G0          | 8.29         | 4       |         |
| 70 760.....   | 13 47.6                           | 70 19     | .....        | A0          | 8.22         | 4       |         |
| 66 821.....   | 13 47.7                           | 66 29     | .....        | F0          | 8.35         | 4       |         |
| 65 963.....   | 13 48.5                           | 65 13     | 4.77         | Ma          | 6.28         | 6       |         |
| 62 1322.....  | 13 51.2                           | 62 36     | .....        | K0          | 8.30         | 3       |         |
| 69 726.....   | 13 51.3                           | 69 45     | 8.24         | A3          | 8.31         | 4       |         |
| 63 1102.....  | 13 51.6                           | 62 53     | 7.26         | K0          | 8.16         | 4       |         |
| 63 1103.....  | 13 52.8                           | 63 39     | .....        | F2          | 8.08         | 4       |         |
| 70 762.....   | 13 53.4                           | 70 27     | 7.38         | K0          | 8.26         | 4       |         |
| 66 825.....   | 13 53.6                           | 65 42     | 7.58         | F5          | 8.28         | 5       |         |
| 63 1105.....  | 13 54.1                           | 63 18     | 7.32         | F5          | 7.71         | 4       |         |
| 62 1325.....  | 13 54.4                           | 61 59     | 6.40         | K5          | 7.43         | 6       |         |
| 65 966.....   | 13 55.7                           | 65 24     | 6.99         | K0          | 8.15         | 7       |         |
| 66 827.....   | 13 56.0                           | 66 36     | .....        | F8          | 7.93         | 6       |         |
| 65 964.....   | 13 56.4                           | 64 53     | 7.20         | K2          | 8.18         | 6       |         |
| 60 1505.....  | 13 58.0                           | 60 03     | .....        | F8          | 8.44         | 5       |         |
| 63 1109.....  | 13 58.5                           | 73 53     | 7.68         | G5          | 8.10         | 4       |         |

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| 69° 733..... | 13 <sup>h</sup> 59 <sup>m</sup> 6 <sup>s</sup> | 69° 10'   | .....     | B8       | 7.98      | 7       |               |
| 62 1327..... | 13 59.8  | 62 10     | 7.30      | A2       | 7.61      | 4       | S             |
| 62 1328..... | 13 59.9  | 62 46     | .....     | Fo       | 8.26      | 4       |               |
| 70 769.....  | 14 1.5   | 70 46     | 7.69      | K5       | 8.29      | 4       |               |
| 70 774.....  | 14 7.6   | 70 04     | 7.14      | B9       | 7.20      | 7       | S             |
| 69 736.....  | 14 8.1   | 69 20     | 6.56      | Ko       | 7.96      | 7       |               |
| 63 1120..... | 14 8.1   | 62 59     | .....     | F5       | 8.27      | 3       |               |
| 61 1409..... | 14 8.7   | 60 57     | 8.00      | F5       | 8.19      | 6       |               |
| 70 778.....  | 14 10.2  | 69 54     | 5.36      | Ma       | 6.93      | 7       |               |
| 63 1121..... | 14 10.6  | 63 09     | 7.67      | Fo       | 8.04      | 5       |               |
| 65 987.....  | 14 13.5  | 65 18     | 7.16      | Ao       | 7.51      | 5       | S P.D.M.=7.53 |
| 63 1123..... | 14 13.8  | 63 32     | .....     | F8       | 8.39      | 3       |               |
| 63 1125..... | 14 15.2  | 63 13     | .....     | Ao       | 8.41      | 4       |               |
| 69 741.....  | 14 15.9  | 69 12     | 7.34      | F2       | 7.93      | 6       |               |
| 65 991.....  | 14 16.7  | 64 50     | 8.05      | A5       | 8.26      | 5       |               |
| 67 831.....  | 14 17.4  | 67 34     | .....     | A3       | 8.30      | 5       |               |
| 63 1128..... | 14 17.6  | 63 40     | .....     | A2       | 8.33      | 5       |               |
| 68 777.....  | 14 18.0  | 68 15     | 6.71      | Ao       | 6.77      | 6       | S             |
| 66 842.....  | 14 18.8  | 65 49     | 7.00      | F5       | 7.64      | 5       |               |
| 68 781.....  | 14 19.2  | 68 16     | 7.09      | A2       | 7.24      | 5       | S P.D.M.=7.37 |
| 62 1345..... | 14 19.3  | 62 44     | .....     | Ao       | 8.38      | 3       |               |
| 61 1422..... | 14 19.7  | 61 26     | 7.23      | Go       | 7.76      | 6       |               |
| 60 1534..... | 14 19.7  | 60 14     | 7.61      | Ko       | 8.27      | 6       |               |
| 63 1131..... | 14 22.3  | 63 24     | 7.13      | F8       | 7.72      | 5       |               |
| 66 847.....  | 14 23.3  | 66 26     | 7.14      | F2       | 7.64      | 5       |               |
| 60 1541..... | 14 24.8  | 60 10     | 7.96      | F5       | 7.80      | 4       |               |
| 61 1432..... | 14 26.2  | 60 50     | 7.32      | A2       | 7.44      | 4       | S             |
| 69 749.....  | 14 26.4  | 69 42     | 7.79      | Go       | 8.28      | 6       |               |
| 76 527.....  | 14 27.7  | 76 08     | 4.37      | K2       | 6.22      | 3       |               |
| 73 631.....  | 14 27.8  | 73 30     | .....     | A2       | 8.19      | 4       |               |
| 63 1136..... | 14 28.4  | 63 38     | 6.04      | F5       | 6.50      | 2       |               |
| 60 1547..... | 14 29.0  | 60 40     | 6.18      | Fo       | 6.32      | 4       |               |
| 68 787.....  | 14 29.1  | 68 31     | 7.18      | A3       | 7.59      | 4       | S             |
| 70 792.....  | 14 30.3  | 70 41     | .....     | F2       | 8.27      | 4       |               |
| 66 855.....  | 14 31.5  | 14 50     | 6.63      | F5       | 6.95      | 4       |               |
| 63 1141..... | 14 32.1  | 63 38     | 7.38      | K2       | 8.53      | 2       |               |
| 67 843.....  | 14 32.6  | 67 14     | 7.54      | F8       | 8.00      | 3       |               |
| 66 856.....  | 14 32.8  | 66 25     | 7.87      | Fo       | 8.09      | 4       |               |
| 64 1114..... | 14 34.0  | 63 54     | 7.84      | A3       | 8.25      | 2       | S P.D.M.=8.34 |
| 64 1017..... | 14 36.9  | 64 43     | 7.45      | F8       | 8.10      | 4       |               |
| 64 1018..... | 14 37.2  | 64 35     | 7.50      | F2       | 7.87      | 3       |               |
| 66 863.....  | 14 37.8  | 66 46     | 7.43      | G5       | 7.84      | 3       |               |
| 72 650.....  | 14 38.3  | 72 42     | 7.95      | F5       | 8.24      | 5       |               |
| 61 1451..... | 14 39.5  | 61 41     | 6.17      | F2       | 6.38      | 6       |               |
| 60 1557..... | 14 39.9  | 60 39     | .....     | Fo       | 8.11      | 5       |               |

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|---------------|-----------------------------------|-----------|--------------|-------------|--------------|---------|-----------------|
| 61° 1454..... | 14 <sup>h</sup> 41 <sup>m</sup> 6 | 61° 32'   | 6.60         | F2          | 6.98         | 5       |                 |
| 69 1560.....  | 14 42.0                           | 60 29     | 7.46         | Ko          | 8.35         | 4       |                 |
| 65 1011.....  | 14 43.3                           | 65 47     | .....        | F5          | 7.63         | 3       |                 |
| 65 1012.....  | 14 44.0                           | 65 03     | 7.85         | Ao          | 8.00         | 3       |                 |
| 60 1567.....  | 14 44.5                           | 60 08     | 7.21         | A2          | 7.40         | 4       | S P.D.M. = 7.58 |
| 72 652.....   | 14 45.3                           | 72 23     | 7.40         | A5          | 7.50         | 5       | S               |
| 62 1308.....  | 14 45.3                           | 61 59     | .....        | A2          | 7.89         | 5       |                 |
| 65 1015.....  | 14 45.7                           | 65 39     | 7.22         | A5          | 7.90         | 3       | S P.D.M. = 8.00 |
| 72 653.....   | 14 47.1                           | 72 02     | 7.77         | F2          | 8.00         | 4       |                 |
| 73 646.....   | 14 50.1                           | 73 27     | .....        | A2          | 7.59         | 4       |                 |
| 70 813.....   | 14 52.7                           | 70 10     | 7.64         | K5          | 8.41         | 2       |                 |
| 66 878.....   | 14 56.0                           | 66 20     | 4.86         | Mb          | 6.37         | 3       |                 |
| 62 1380.....  | 14 56.5                           | 62 04     | 7.04         | A2          | 7.06         | 4       | S               |
| 66 882.....   | 14 58.3                           | 65 52     | 6.95         | Ko          | 8.01         | 3       |                 |
| 60 1582.....  | 14 59.1                           | 60 36     | 5.89         | A2          | 5.86         | 6       | S               |
| 71 706.....   | 14 59.6                           | 71 00     | 7.64         | F8          | 8.12         | 4       |                 |
| 72 664.....   | 15 0.4                            | 72 09     | 6.66         | Go          | 7.20         | 3       |                 |
| 60 1584.....  | 15 1.1                            | 60 26     | 6.81         | K5          | .....        | 5       | Var.?           |
| 68 817.....   | 15 1.3                            | 68 16     | .....        | F8          | 8.39         | 3       |                 |
| 66 886.....   | 15 1.4                            | 66 10     | 7.26         | Go          | 7.86         | 3       |                 |
| 66 887.....   | 15 2.4                            | 66 18     | 7.00         | Ao          | 7.11         | 3       | S               |
| 60 1589.....  | 15 4.0                            | 60 12     | 7.51         | F2          | 7.87         | 4       |                 |
| 66 889.....   | 15 5.0                            | 66 07     | .....        | Ao          | 8.32         | 2       |                 |
| 74 602.....   | 15 5.6                            | 74 16     | 7.15         | Ao          | 7.57         | 2       | S               |
| 65 1036.....  | 15 5.9                            | 65 06     | 7.30         | Ko          | 8.46         | 2       |                 |
| 63 1167.....  | 15 5.9                            | 63 30     | 6.75         | F2          | 7.08         | 2       |                 |
| 66 890.....   | 15 6.8                            | 66 11     | 6.82         | Ma          | 8.45         | 2       |                 |
| 65 1039.....  | 15 7.0                            | 64 56     | 7.20         | Ko          | 8.14         | 2       |                 |
| 70 827.....   | 15 8.4                            | 70 02     | 7.04         | F2          | 7.29         | 2       |                 |
| 72 671.....   | 15 8.5                            | 72 44     | .....        | Go          | 7.28         | 2       |                 |
| 68 823.....   | 15 9.7                            | 68 10     | 6.15         | A2          | 6.24         | 4       | S               |
| 66 894.....   | 15 9.9                            | 66 01     | 7.66         | A2          | 8.02         | 3       | S P.D.M. = 8.12 |
| 62 1392.....  | 15 9.9                            | 62 13     | 7.34         | Go          | 7.80         | 5       |                 |
| 67 876.....   | 15 13.5                           | 67 44     | 5.23         | Go          | 5.74         | 4       |                 |
| 69 789.....   | 15 14.1                           | 69 18     | 6.50         | Ao          | 6.38         | 2       | S               |
| 63 1182.....  | 15 15.4                           | 63 08     | 6.77         | Ko          | 7.80         | 3       |                 |
| 69 793.....   | 15 17.0                           | 69 31     | 7.34         | Ko          | 8.21         | 2       |                 |
| 63 1185.....  | 15 17.1                           | 63 31     | .....        | A3          | 8.35         | 2       |                 |
| 72 647.....   | 15 17.2                           | 72 11     | 5.14         | Ko          | 6.54         | 4       |                 |
| 71 722.....   | 15 17.2                           | 71 34     | 7.19         | F8          | 7.52         | 3       |                 |
| 65 1048.....  | 15 17.2                           | 65 47     | .....        | A2          | 7.88         | 3       |                 |
| 61 1495.....  | 15 17.3                           | 61 43     | 7.33         | Go          | 7.82         | 4       |                 |
| 60 1605.....  | 15 17.8                           | 60 42     | 7.62         | F2          | 7.92         | 4       |                 |
| 62 1406.....  | 15 18.0                           | 62 50     | 6.64         | K2          | 7.97         | 3       |                 |
| 60 1606.....  | 15 18.0                           | 60 44     | 7.44         | Fo          | 7.66         | 4       |                 |

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|--------------|-----------------------------------|-----------|-----------|----------|-----------|---------|-----------------|
| 74° 609..... | 15 <sup>h</sup> 18 <sup>m</sup> 3 | 74° 24'   | 6.66      | Ko       | 7.79      | 2       | S               |
| 67 883.....  | 15 18.8                           | 67 22     | .....     | A5       | 8.25      | 3       |                 |
| 62 1410..... | 15 20.7                           | 62 23     | 5.80      | B9       | 5.83      | 3       |                 |
| 63 1192..... | 15 21.0                           | 63 42     | 5.78      | K5       | 7.19      | 3       |                 |
| 63 1194..... | 15 21.3                           | 63 28     | 7.39      | Ko       | 8.36      | 3       |                 |
| 63 1195..... | 15 22.1                           | 63 17     | .....     | F5       | 8.19      | 2       | S P.D.M. = 6.70 |
| 73 672.....  | 15 22.3                           | 73 50     | 7.36      | F5       | 7.77      | 2       |                 |
| 62 1414..... | 15 25.8                           | 62 37     | 6.37      | Ao       | 6.54      | 3       |                 |
| 61 1509..... | 15 25.9                           | 61 01     | 6.08      | K5       | 7.51      | 4       |                 |
| 62 1415..... | 15 26.8                           | 62 05     | 6.79      | Ao       | 6.82      | 5       |                 |
| 62 1416..... | 15 27.6                           | 62 27     | 6.49      | K5       | 7.76      | 3       | S               |
| 64 1074..... | 15 29.5                           | 64 33     | 5.88      | G5       | 6.72      | 3       |                 |
| 67 901.....  | 15 30.0                           | 67 01     | .....     | Fo       | 8.34      | 2       |                 |
| 68 842.....  | 15 33.9                           | 68 08     | 6.90      | G5       | 7.66      | 4       |                 |
| 65 1062..... | 15 34.0                           | 65 36     | 7.50      | A2       | 7.55      | 5       |                 |
| 69 806.....  | 15 37.4                           | 69 36     | 5.86      | Ko       | 7.09      | 5       | S               |
| 66 915.....  | 15 37.5                           | 66 07     | 7.06      | Ko       | 8.20      | 5       |                 |
| 71 741.....  | 15 38.0                           | 71 29     | 7.12      | Ko       | 8.00      | 3       |                 |
| 69 808.....  | 15 38.4                           | 69 08     | .....     | F5       | 7.75      | 5       |                 |
| 67 912.....  | 15 40.0                           | 67 38     | .....     | A2       | 7.29      | 3       |                 |
| 67 916.....  | 15 43.8                           | 67 37     | .....     | F2       | 8.29      | 2       | S               |
| 69 812.....  | 15 44.4                           | 68 59     | 7.21      | A2       | 7.35      | 5       |                 |
| 63 1225..... | 15 45.1                           | 62 54     | 5.13      | A2       | 5.30      | 3       |                 |
| 66 920.....  | 15 45.6                           | 66 10     | .....     | A3       | 8.41      | 3       |                 |
| 69 813.....  | 15 46.9                           | 69 47     | 7.44      | A2       | 7.50      | 6       |                 |
| 62 1431..... | 15 46.9                           | 62 40     | .....     | A2p      | 8.33      | 3       | S               |
| 70 846.....  | 15 47.0                           | 70 41     | 7.70      | F8       | 8.06      | 4       |                 |
| 60 1637..... | 15 47.5                           | 60 50     | 7.81      | F5       | 8.04      | 5       |                 |
| 63 1228..... | 15 47.7                           | 63 28     | .....     | Fo       | 8.33      | 2       |                 |
| 65 1081..... | 15 49.0                           | 65 06     | 7.15      | Ao       | 7.32      | 3       |                 |
| 66 923.....  | 15 49.9                           | 66 43     | .....     | A3       | 8.18      | 5       | S               |
| 65 1087..... | 15 52.5                           | 65 34     | 6.90      | G5       | 7.77      | 5       |                 |
| 69 825.....  | 15 53.4                           | 64 01     | 6.82      | F5       | 7.15      | 8       |                 |
| 72 703.....  | 15 56.6                           | 77 41     | 7.46      | Ko       | 8.20      | 3       |                 |
| 66 927.....  | 15 58.1                           | 66 20     | .....     | A3       | 8.30      | 4       |                 |
| 71 762.....  | 15 58.9                           | 71 10     | 7.42      | G5       | 7.79      | 5       | S               |
| 68 858.....  | 16 0.0                            | 67 59     | 6.82      | F2       | 7.37      | 7       |                 |
| 65 1095..... | 16 0.0                            | 65 14     | 7.10      | A2       | 7.12      | 5       |                 |
| 74 650.....  | 16 1.9                            | 74 13     | 7.96      | Ko       | 8.64      | 2       |                 |
| 71 767.....  | 16 4.6                            | 71 24     | .....     | A2       | 8.17      | 5       |                 |
| 65 1098..... | 16 5.1                            | 64 57     | 7.30      | Ko       | 8.35      | 2       | S               |
| 70 863.....  | 16 5.2                            | 70 32     | 6.74      | Ao       | 6.68      | 5       |                 |
| 73 707.....  | 16 5.4                            | 73 25     | 6.95      | F5       | 7.17      | 4       |                 |
| 68 864.....  | 16 6.1                            | 68 04     | 5.40      | Ao       | 5.33      | 7       |                 |
| 63 1253..... | 16 8.2                            | 63 40     | 6.71      | A3       | 6.90      | 3       |                 |

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| 60° 1658..... | 16 <sup>h</sup> 8 <sup>m</sup> 2 | 60° 08'   | 6.70         | Ao          | 6.58         | 3       | S       |
| 71 768.....   | 16 11.7                          | 71 34     | 8.28         | F5          | 8.28         | 4       |         |
| 72 718.....   | 16 11.8                          | 72 39     | 7.78         | Ao          | 7.91         | 4       |         |
| 67 930.....   | 16 12.1                          | 67 24     | 6.28         | Ko          | 7.27         | 8       |         |
| 66 941.....   | 16 12.8                          | 66 52     | .....        | Go          | 8.40         | 3       |         |
| 72 770.....   | 16 14.5                          | 72 01     | .....        | A3          | 8.31         | 4       |         |
| 71 775.....   | 16 15.5                          | 71 11     | 7.77         | G5          | 8.22         | 5       |         |
| 60 1665.....  | 16 15.6                          | 60 00     | 5.64         | Mb          | 7.09         | 3       |         |
| 73 713.....   | 16 16.2                          | 73 38     | 5.98         | Ao          | 5.85         | 3       |         |
| 68 868.....   | 16 18.2                          | 68 48     | 6.47         | Ko          | 7.71         | 4       |         |
| 70 874.....   | 16 20.1                          | 70 36     | 7.46         | F8          | 7.86         | 5       |         |
| 62 1476.....  | 16 21.5                          | 61 55     | .....        | G5          | 6.48         | 4       |         |
| 69 845.....   | 15 22.0                          | 69 20     | 5.44         | Ko          | 6.36         | 7       |         |
| 70 877.....   | 16 22.3                          | 70 44     | 7.28         | Ko          | 8.16         | 5       |         |
| 61 1591.....  | 16 22.6                          | 61 44     | 2.89         | G5          | 4.66         | 3       |         |
| 67 941.....   | 16 25.1                          | 67 18     | 7.40         | Ko          | 8.45         | 6       |         |
| 71 789.....   | 16 26.5                          | 71 36     | 7.16         | F8          | 7.48         | 5       |         |
| 67 942.....   | 16 28.1                          | 67 16     | 6.73         | Ma          | 8.30         | 6       |         |
| 69 850.....   | 16 28.2                          | 68 59     | 4.98         | B8p         | 4.88         | 7       |         |
| 65 1122.....  | 16 28.3                          | 65 00     | 7.75         | Go          | 8.29         | 4       |         |
| 63 1278.....  | 16 29.5                          | 63 47     | 7.90         | Fo          | 8.28         | 2       |         |
| 67 945.....   | 16 30.2                          | 67 34     | 8.48         | Go          | 8.56         | 2       |         |
| 61 1598.....  | 16 31.0                          | 61 02     | 5.85         | Ao          | 5.89         | 3       | S       |
| 63 1281.....  | 16 31.6                          | 63 04     | 7.22         | Fo          | 7.63         | 3       |         |
| 61 1599.....  | 16 32.0                          | 61 26     | .....        | Ao          | 7.58         | 3       |         |
| 71 797.....   | 16 32.7                          | 71 08     | .....        | F5          | 8.22         | 7       |         |
| 72 734.....   | 16 33.0                          | 72 49     | 6.45         | Ko          | 7.64         | 5       |         |
| 63 1284.....  | 16 33.6                          | 63 28     | .....        | K2          | 7.89         | 3       |         |
| 68 879.....   | 16 34.0                          | 68 13     | 7.28         | Ko          | 8.56         | 3       |         |
| 62 1492.....  | 16 34.7                          | 62 34     | .....        | F2          | 8.23         | 2       |         |
| 61 1604.....  | 16 36.9                          | 61 23     | 7.01         | K5          | 8.26         | 5       |         |
| 70 887.....   | 16 37.2                          | 70 00     | 8.04         | F5          | 8.22         | 9       |         |
| 69 800.....   | 16 38.4                          | 69 22     | .....        | Fo          | 7.88         | 7       |         |
| 68 880.....   | 16 39.4                          | 68 31     | .....        | Go          | 8.53         | 3       |         |
| 62 1501.....  | 16 40.0                          | 62 30     | 7.24         | B8          | 7.06         | 3       | S       |
| 64 1145.....  | 16 40.2                          | 64 47     | 5.00         | Ko          | 6.03         | 5       |         |
| 64 1147.....  | 16 41.2                          | 64 00     | .....        | G5          | 8.21         | 2       |         |
| 72 745.....   | 16 42.5                          | 72 51     | 6.94         | Ma          | 8.29         | 4       |         |
| 68 883.....   | 16 42.9                          | 68 17     | 7.65         | G5          | 8.59         | 2       |         |
| 61 1609.....  | 16 43.0                          | 61 09     | 7.72         | Ao          | 7.92         | 5       | S       |
| 65 1141.....  | 16 43.7                          | 65 25     | .....        | Ko          | 8.48         | 3       |         |
| 74 680.....   | 16 44.2                          | 74 04     | 6.76         | A2          | 6.79         | 3       | S       |
| 63 1303.....  | 16 45.8                          | 62 57     | .....        | A2          | 8.05         | 4       |         |
| 68 884.....   | 16 45.9                          | 68 26     | .....        | Go          | 8.85         | 3       |         |
| 63 1307.....  | 16 46.4                          | 63 42     | 7.07         | K5          | 8.16         | 2       |         |

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| 66° 975..... | 16 <sup>h</sup> 46 <sup>m</sup> 5 | 66° 13'   | .....     | A2       | 8.08      | 6       |                 |
| 67 969.....  | 16 47.0                           | 67 26     | 7.22      | K2       | 8.78      | 3       |                 |
| 69 872.....  | 16 47.8                           | 69 16     | 7.36      | Ao       | 7.52      | 6       | S               |
| 60 1706..... | 16 47.8                           | 60 18     | .....     | F2       | 8.19      | 4       |                 |
| 68 888.....  | 16 47.9                           | 68 01     | 7.66      | Ko       | 8.60      | 3       |                 |
| 70 899.....  | 16 48.6                           | 70 17     | .....     | G5       | 8.33      | 5       |                 |
| 72 754.....  | 16 49.4                           | 72 07     | .....     | F8       | 8.40      | 3       |                 |
| 67 971.....  | 16 49.5                           | 67 46     | .....     | Ko       | 8.95      | 3       |                 |
| 69 891.....  | 16 49.7                           | 69 05     | .....     | A2       | 8.56      | 5       |                 |
| 67 984.....  | 16 51.7                           | 67 49     | .....     | G5       | 8.59      | 3       |                 |
| 68 893.....  | 16 52.1                           | 68 05     | .....     | Ao       | 7.49      | 7       |                 |
| 60 1713..... | 16 52.7                           | 60 32     | 7.16      | Ko       | 8.34      | 4       |                 |
| 61 1619..... | 16 52.9                           | 61 48     | .....     | Go       | 8.40      | 5       |                 |
| 62 1520..... | 16 53.8                           | .....     | 7.04      | G5       | 7.59      | 2       |                 |
| 62 1521..... | 16 55.3                           | 62 31     | 6.79      | Ao       | 6.80      | 4       |                 |
| 70 906.....  | 16 55.4                           | 70 37     | 6.95      | A2       | 6.90      | 6       |                 |
| 65 1157..... | 16 55.5                           | 65 17     | 4.82      | F5       | 5.30      | 8       |                 |
| 61 1623..... | 16 55.6                           | 61 38     | 7.32      | Ko       | 8.22      | 5       |                 |
| 67 977.....  | 16 55.8                           | 67 38     | 6.72      | Ao       | 6.64      | 7       |                 |
| 65 1150..... | 16 55.9                           | 65 11     | 6.44      | Fo       | 6.54      | 8       |                 |
| 74 690.....  | 16 56.2                           | 74 27     | 7.62      | Fo       | 7.59      | 2       |                 |
| 73 751.....  | 16 58.3                           | 73 17     | 6.24      | A5       | 6.22      | 4       |                 |
| 71 817.....  | 16 58.7                           | 71 36     | .....     | G5       | 8.42      | 6       |                 |
| 74 695.....  | 16 58.8                           | 74 26     | 7.17      | F5       | 7.50      | 3       |                 |
| 69 884.....  | 16 59.6                           | 69 20     | 6.52      | Ko       | 7.12      | 7       |                 |
| 68 908.....  | 16 59.7                           | 68 50     | 7.32      | A5       | 7.82      | 8       | S               |
| 60 1728..... | 17 0.1                            | 60 47     | 6.24      | Ko       | 7.15      | 6       |                 |
| 64 1170..... | 17 1.7                            | 64 44     | 6.09      | Ko       | 7.24      | 7       |                 |
| 61 1636..... | 17 2.9                            | 61 18     | .....     | Ko       | 8.65      | 5       |                 |
| 73 755.....  | 17 3.4                            | 73 27     | 7.70      | K2       | 8.36      | 2       |                 |
| 71 822.....  | 17 4.1                            | 71 12     | 7.64      | K5       | 8.53      | 6       |                 |
| 69 891.....  | 17 4.4                            | 69 55     | 7.89      | F5       | 8.27      | 9       |                 |
| 61 1640..... | 17 7.0                            | 61 17     | 6.69      | F5       | 7.28      | 4       |                 |
| 72 768.....  | 17 10.1                           | 72 15     | 7.58      | K2       | 8.35      | 5       |                 |
| 61 1645..... | 17 10.7                           | 61 50     | .....     | F2       | 8.22      | 5       |                 |
| 66 999.....  | 17 10.8                           | 66 23     | .....     | A2       | 7.78      | 7       |                 |
| 73 759.....  | 17 10.9                           | 73 17     | .....     | A2       | 8.18      | 4       |                 |
| 63 1334..... | 17 11.1                           | 63 15     | .....     | A2       | 8.16      | 4       |                 |
| 63 1336..... | 17 11.7                           | 62 59     | 5.47      | A3       | 5.69      | 5       | S P.D.M. = 5.68 |
| 67 995.....  | 17 12.9                           | 67 44     | .....     | A3       | 8.47      | 7       |                 |
| 60 1742..... | 17 14.9                           | 60 49     | 6.73      | Fo       | 7.10      | 5       |                 |
| 64 1191..... | 17 17.0                           | 64 08     | 7.18      | K2       | 7.96      | 4       |                 |
| 71 835.....  | 17 17.8                           | 71 54     | 6.81      | K2       | 7.96      | 7       |                 |
| 63 1343..... | 17 18.3                           | 63 50     | 7.22      | Ao       | 7.46      | 4       | S               |
| 70 925.....  | 17 20.2                           | 70 53     | 7.00      | Ao       | 7.11      | 7       | S               |

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| 65° 1176..... | 17 <sup>h</sup> 20 <sup>m</sup> 4 | 65° 44'   | 7.62         | F2          | 8.20         | 5       |               |
| 61 1656.....  | 17 20.7                           | 61 49     | .....        | F5          | 8.64         | 4       |               |
| 69 910.....   | 17 20.9                           | 69 51     | 7.14         | K2          | 8.37         | 10      |               |
| 66 1013.....  | 17 20.9                           | 66 39     | 7.03         | K2          | 8.30         | 7       |               |
| 69 911.....   | 17 22.0                           | 69 54     | 7.39         | F8          | 7.98         | 9       |               |
| 61 1650.....  | 17 22.5                           | 61 06     | 7.21         | Ko          | 8.48         | 4       |               |
| 73 767.....   | 17 22.9                           | 73 06     | .....        | Ko          | 8.68         | 3       |               |
| 60 1754.....  | 17 24.4                           | 60 07     | 5.66         | Ao          | 5.74         | 4       | S             |
| 71 841.....   | 17 24.9                           | 71 57     | 7.05         | Mb          | 8.58         | 4       |               |
| 67 1014.....  | 17 25.3                           | 67 23     | 6.31         | Ko          | 7.25         | 5       |               |
| 73 772.....   | 17 26.4                           | 73 02     | .....        | Ko          | 8.54         | 3       |               |
| 67 1015.....  | 17 26.6                           | 67 51     | .....        | A5          | 7.84         | 7       |               |
| 73 774.....   | 17 27.6                           | 73 18     | .....        | Ao          | 8.52         | 3       |               |
| 72 791.....   | 17 28.5                           | 72 53     | 7.55         | Ko          | 8.33         | 3       |               |
| 68 932.....   | 17 28.8                           | 68 34     | .....        | A2          | 8.42         | 7       |               |
| 63 1358.....  | 17 29.1                           | 63 56     | 7.43         | Go          | 8.34         | 3       | P.D.M. = 7.83 |
| 71 845.....   | 17 31.1                           | 71 22     | .....        | Ao          | 8.46         | 5       |               |
| 74 713.....   | 17 31.3                           | 74 34     | 8.17         | F2          | 8.34         | 2       |               |
| 69 925.....   | 17 32.1                           | 69 40     | 7.32         | Ko          | 8.23         | 9       |               |
| 68 938.....   | 17 32.4                           | 68 12     | 5.21         | Ko          | 6.07         | 7       |               |
| 67 1019.....  | 17 32.8                           | 67 03     | .....        | F2          | 8.38         | 4       |               |
| 71 846.....   | 17 32.9                           | 71 19     | 7.76         | K2          | 8.72         | 2       |               |
| 60 1764.....  | 17 32.9                           | 60 09     | .....        | F5          | 7.79         | 4       |               |
| 67 1021.....  | 17 33.5                           | 67 16     | .....        | F2          | 8.08         | 5       |               |
| 61 1678.....  | 17 33.9                           | 61 58     | 5.31         | F8          | 5.71         | 4       |               |
| 74 717.....   | 17 35.5                           | 74 17     | 7.06         | K2          | 7.63         | 4       |               |
| 63 1362.....  | 17 35.8                           | 63 23     | .....        | A3          | 8.22         | 2       |               |
| 61 1683.....  | 17 36.1                           | 61 01     | .....        | A5          | 8.54         | 4       |               |
| 69 930.....   | 17 36.4                           | 69 20     | .....        | Ko          | 8.30         | 7       |               |
| 62 1561.....  | 17 36.7                           | 62 00     | .....        | Ao          | 7.90         | 5       |               |
| 67 1027.....  | 17 37.2                           | 67 11     | .....        | A2          | 8.16         | 5       |               |
| 69 933.....   | 17 37.5                           | 69 38     | 6.48         | F8          | 6.82         | 8       |               |
| 68 949.....   | 17 37.5                           | 68 48     | 4.87         | F5          | 5.13         | 8       |               |
| 73 782.....   | 17 38.0                           | 73 07     | .....        | Ao          | 7.86         | 3       |               |
| 72 799.....   | 17 38.5                           | 72 66     | 7.28         | Ao          | 7.52         | 5       |               |
| 74 720.....   | 17 38.8                           | 74 04     | 7.62         | F5          | 8.22         | 3       |               |
| 72 800.....   | 17 39.0                           | 72 30     | 5.96         | Ko          | 6.92         | 6       |               |
| 63 1371.....  | 17 39.7                           | 63 43     | 6.83         | F5          | 7.26         | 3       |               |
| 69 939.....   | 17 41.0                           | 69 12     | 7.08         | F2          | 7.41         | 9       |               |
| 67 1031.....  | 17 41.6                           | 67 12     | 6.87         | K5          | 8.40         | 7       |               |
| 73 786.....   | 17 41.9                           | 72 59     | .....        | F2          | 8.20         | 5       |               |
| 73 787.....   | 17 42.0                           | 73 01     | .....        | A           | 8.11         | 5       |               |
| 72 803.....   | 17 43.1                           | 72 27     | .....        | Ko          | 8.22         | 5       |               |
| 72 804.....   | 17 43.7                           | 72 12     | 4.90         | F5          | 4.79         | 5       |               |
| 73 791.....   | 17 44.4                           | 73 30     | 7.64         | Ao          | 7.78         | 3       | S             |

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| 60° 946..... | 17 <sup>h</sup> 44 <sup>m</sup> 7 | 69° 07'   | .....        | F8          | 8.27         | 7       |                 |
| 63 1377..... | 17 46.5                           | 63 09     | 7.76         | A2          | 7.97         | 3       | S               |
| 64 1222..... | 17 48.3                           | 64 48     | 7.55         | Ao          | 6.80         | 6       | S               |
| 62 1573..... | 17 48.4                           | 62 50     | 6.69         | F2          | 6.88         | 3       |                 |
| 68 961.....  | 17 49.6                           | 68 22     | .....        | A2          | 7.79         | 8       |                 |
| 73 796.....  | 17 49.8                           | 73 10     | 7.52         | Go          | 8.28         | 4       |                 |
| 68 963.....  | 17 50.0                           | 68 43     | 6.87         | A2          | 7.08         | 7       | S               |
| 69 951.....  | 17 51.1                           | 69 12     | .....        | A2          | 8.50         | 6       |                 |
| 60 1787..... | 17 51.2                           | 60 25     | 6.82         | A2          | 6.96         | 3       |                 |
| 61 1707..... | 17 52.5                           | 61 04     | 7.78         | F8          | 8.43         | 3       |                 |
| 63 1388..... | 17 52.6                           | 63 04     | .....        | F2          | 8.30         | 2       |                 |
| 66 1057..... | 17 52.9                           | 66 26     | 7.67         | Ko          | 8.50         | 3       |                 |
| 65 1220..... | 17 54.3                           | 65 02     | 8.25         | F8          | 8.40         | 2       |                 |
| 61 1710..... | 17 54.7                           | 61 25     | 6.82         | A3          | 7.49         | 3       | S P.D.M. = 7.55 |
| 74 740.....  | 17 55.4                           | 74 35     | 6.83         | A3          | 6.86         | 2       | S               |
| 69 958.....  | 17 56.1                           | 69 38     | 7.12         | Fo          | 7.87         | 8       |                 |
| 73 803.....  | 17 56.2                           | 73 08     | .....        | K2          | 8.75         | 4       |                 |
| 72 818.....  | 17 56.9                           | 72 01     | 5.54         | F2          | 5.63         | 4       |                 |
| 60 1798..... | 17 58.9                           | 60 28     | 7.91         | A3          | 8.33         | 5       | S P.D.M. = 8.56 |
| 63 1399..... | 17 59.6                           | 63 33     | 7.10         | K2          | 8.26         | 5       |                 |
| 71 864.....  | 18 1.2                            | 71 37     | .....        | K2          | 8.44         | 6       |                 |
| 65 1233..... | 18 1.3                            | 65 57     | 7.64         | F5          | 8.18         | 6       |                 |
| 63 1402..... | 18 1.8                            | 63 36     | .....        | Ao          | 8.15         | 5       |                 |
| 61 1718..... | 18 3.0                            | 61 33     | .....        | F5          | 8.85         | 5       |                 |
| 65 1240..... | 18 5.1                            | 65 42     | 7.70         | Ao          | 6.97         | 6       | S P.D.M. = 7.36 |
| 65 1241..... | 18 5.2                            | 65 04     | 7.40         | Ko          | 8.30         | 7       |                 |
| 66 1077..... | 18 5.3                            | 66 56     | 6.87         | F5          | 7.58         | 6       |                 |
| 64 1245..... | 18 6.2                            | 64 12     | 6.81         | Ko          | 7.69         | 6       |                 |
| 65 1245..... | 18 6.9                            | 65 52     | 7.72         | A2          | 8.10         | 6       | S P.D.M. = 8.20 |
| 67 1051..... | 18 8.0                            | 67 24     | 7.72         | Ko          | 8.79         | 4       |                 |
| 71 872.....  | 18 8.1                            | 71 26     | .....        | K2          | 8.73         | 4       |                 |
| 61 1727..... | 18 8.9                            | 61 52     | 7.08         | F8          | 7.69         | 4       |                 |
| 67 1052..... | 18 9.3                            | 67 58     | 7.97         | Ao          | 8.00         | 4       | S               |
| 71 876.....  | 18 9.6                            | 71 03     | .....        | A2          | 8.73         | 5       |                 |
| 60 1813..... | 18 9.9                            | 60 23     | 6.32         | Ao          | 6.43         | 4       | S               |
| 67 1054..... | 18 10.3                           | 67 46     | .....        | Go          | 8.45         | 4       |                 |
| 60 1814..... | 18 10.3                           | 60 36     | .....        | F8          | 8.18         | 4       |                 |
| 72 829.....  | 18 10.6                           | 72 08     | .....        | F5          | 7.92         | 6       |                 |
| 66 1087..... | 18 11.7                           | 66 06     | 7.34         | Ko          | 8.35         | 6       |                 |
| 69 970.....  | 18 12.0                           | 69 41     | .....        | Go          | 8.56         | 6       |                 |
| 64 1252..... | 18 13.3                           | 64 22     | 5.03         | F5          | 5.63         | 7       |                 |
| 66 1089..... | 18 13.8                           | 66 27     | .....        | Fo          | 8.26         | 5       |                 |
| 64 1253..... | 18 13.8                           | 64 43     | 7.30         | K2          | 8.52         | 3       |                 |
| 70 1087..... | 18 15.5                           | 70 48     | 7.06         | A3          | 7.22         | 7       | S               |
| 64 1256..... | 18 15.6                           | 64 02     | .....        | A2          | 8.29         | 4       |                 |

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| 68° 984..... | 18 <sup>h</sup> 15 <sup>m</sup> 9 | 68° 43'   | 6.11         | Ko          | 7.11         | 7       |                 |
| 69 973.....  | 18 17.5                           | 69 40     | .....        | F5          | 8.55         | 7       |                 |
| 68 989.....  | 18 17.6                           | 68 42     | 6.72         | Ao          | 6.57         | 8       |                 |
| 69 974.....  | 18 18.9                           | 69 58     | 7.60         | F5          | 8.11         | 10      |                 |
| 64 1263..... | 18 19.8                           | 64 09     | 7.40         | Ko          | 8.24         | 5       |                 |
| 67 1066..... | 18 19.9                           | 67 18     | 7.13         | Ma          | 8.46         | 3       |                 |
| 65 1262..... | 18 20.0                           | 65 16     | .....        | F8          | 8.38         | 8       |                 |
| 71 884.....  | 18 20.7                           | 71 28     | .....        | F5          | 7.00         | 7       |                 |
| 69 977.....  | 18 21.8                           | 70 00     | 7.89         | Go          | 8.11         | 7       |                 |
| 71 889.....  | 18 22.2                           | 71 17     | 4.24         | Aop         | 4.32         | 5       |                 |
| 62 1616..... | 18 22.6                           | 62 43     | .....        | A2          | 8.37         | 5       |                 |
| 72 839.....  | 18 22.8                           | 72 42     | 3.69         | F8          | 4.44         | 5       |                 |
| 60 1827..... | 18 24.7                           | 60 25     | .....        | F2          | 8.61         | 5       |                 |
| 64 1266..... | 18 24.8                           | 64 46     | 7.25         | Ko          | 8.35         | 7       |                 |
| 65 1271..... | 18 25.7                           | 65 30     | 4.99         | Ko          | 6.12         | 7       |                 |
| 70 998.....  | 18 26.9                           | 70 21     | .....        | Ao          | 8.13         | 6       |                 |
| 71 894.....  | 18 27.5                           | 71 40     | 7.39         | F5          | 7.67         | 7       |                 |
| 64 1270..... | 18 29.4                           | 65 00     | 8.30         | A2          | 8.41         | 8       |                 |
| 68 1001..... | 18 30.0                           | 68 35     | .....        | F8          | 8.54         | 3       |                 |
| 62 1629..... | 18 30.4                           | 62 28     | 7.02         | F2          | 7.34         | 4       |                 |
| 65 1276..... | 18 30.9                           | 65 22     | 6.31         | A3          | 6.80         | 7       | S P.D.M. = 6.80 |
| 67 1079..... | 18 32.6                           | 67 42     | 6.81         | K5          | 8.24         | 8       |                 |
| 68 1003..... | 18 33.0                           | 68 32     | .....        | G5          | 8.07         | 7       |                 |
| 69 988.....  | 18 33.4                           | 69 53     | 8.24         | Ao          | 8.32         | 9       |                 |
| 66 1112..... | 18 33.8                           | 66 16     | 7.18         | Ao          | 7.46         | 7       | S P.D.M. = 7.76 |
| 68 1005..... | 18 34.2                           | 66 59     | .....        | G5          | 8.55         | 4       |                 |
| 64 1276..... | 18 35.8                           | 64 59     | 8.30         | Ao          | 8.48         | 4       |                 |
| 65 1283..... | 18 35.9                           | 65 24     | 6.00         | A3          | 6.28         | 7       | S P.D.M. = 6.30 |
| 72 852.....  | 18 36.1                           | 72 20     | 7.34         | Ko          | 8.27         | 6       |                 |
| 66 1117..... | 18 36.4                           | 66 50     | 7.58         | Ko          | 8.25         | 8       |                 |
| 72 855.....  | 18 37.0                           | 72 11     | 7.41         | Ko          | 8.31         | 5       |                 |
| 70 1012..... | 18 37.1                           | 70 22     | 7.64         | Ko          | 8.40         | 5       |                 |
| 67 1085..... | 18 37.2                           | 67 43     | 7.36         | Ao          | 7.53         | 9       |                 |
| 60 1840..... | 18 37.2                           | 60 37     | 6.59         | F2          | 7.10         | 5       |                 |
| 72 857.....  | 18 37.7                           | 72 18     | 6.93         | K3          | 8.14         | 6       |                 |
| 63 1445..... | 18 37.7                           | 63 26     | 6.88         | Ko          | 8.16         | 3       |                 |
| 73 831.....  | 18 37.9                           | 73 12     | 7.45         | G5          | 8.30         | 4       |                 |
| 67 1087..... | 18 38.5                           | 67 02     | .....        | G5          | 8.34         | 8       |                 |
| 63 1446..... | 18 38.6                           | 63 41     | .....        | A3          | 8.50         | 2       |                 |
| 62 1641..... | 18 40.1                           | 62 39     | 6.01         | Ko          | 7.08         | 3       |                 |
| 72 859.....  | 18 41.0                           | 72 53     | .....        | K5          | 8.30         | 6       |                 |
| 74 789.....  | 18 41.2                           | 74 32     | .....        | A5          | 8.35         | 2       |                 |
| 60 1845..... | 18 43.1                           | 60 50     | 6.23         | Ko          | 7.19         | 5       |                 |
| 62 1645..... | 18 43.3                           | 62 53     | .....        | A2          | 8.22         | 2       |                 |
| 71 906.....  | 18 43.7                           | 71 33     | .....        | G5          | 8.55         | 4       |                 |

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| 70° 1020..... | 18 <sup>h</sup> 43 <sup>m</sup> 8 | 70° 29'   | .....     | Ao       | 7.64      | 13      |                 |
| 69 999.....   | 18 43.9                           | 69 15     | 7.94      | G5       | 8.39      | 9       |                 |
| 64 1289.....  | 18 44.1                           | 64 42     | 7.30      | Ko       | 8.39      | 4       |                 |
| 70 1023.....  | 18 44.3                           | 70 41     | 6.56      | K2       | 7.81      | 9       |                 |
| 63 1461.....  | 18 45.9                           | 63 09     | 7.28      | Ko       | 8.31      | 3       |                 |
| 68 1010.....  | 18 46.3                           | 68 38     | .....     | Ao       | 7.77      | 7       |                 |
| 67 1006.....  | 18 47.0                           | 67 40     | 7.00      | Ao       | 7.00      | 8       |                 |
| 73 835.....   | 18 48.3                           | 73 58     | 5.38      | G5       | 6.13      | 4       |                 |
| 60 1852.....  | 18 49.0                           | 60 43     | 6.78      | K2       | 8.20      | 4       |                 |
| 68 1026.....  | 18 49.2                           | 68 28     | .....     | F8       | 8.60      | 3       |                 |
| 61 1783.....  | 18 49.6                           | 61 52     | .....     | A2       | 8.46      | 4       |                 |
| 74 792.....   | 18 49.7                           | 74 36     | 7.72      | Go       | 7.53      | 2       |                 |
| 66 1142.....  | 18 54.0                           | 66 59     | 7.42      | Ao       | 7.62      | 9       | S P.D.M. = 7.78 |
| 74 796.....   | 18 54.4                           | 74 20     | .....     | F2       | 8.35      | 3       |                 |
| 71 914.....   | 18 54.4                           | 71 39     | 6.94      | A2       | 7.00      | 7       | S               |
| 73 843.....   | 18 55.6                           | 73 58     | .....     | G5       | 8.33      | 4       |                 |
| 71 915.....   | 18 55.6                           | 71 10     | 4.91      | Ko       | 6.03      | 9       |                 |
| 65 1309.....  | 18 56.0                           | 65 07     | 5.78      | Ko       | 6.60      | 7       |                 |
| 62 1669.....  | 18 56.3                           | 62 16     | 6.44      | Ko       | 7.38      | 4       |                 |
| 68 1035.....  | 18 57.1                           | 68 09     | 7.47      | G5       | 8.30      | 9       |                 |
| 60 1864.....  | 18 57.3                           | 60 32     | 6.69      | Ao       | 6.87      | 6       |                 |
| 72 871.....   | 18 57.4                           | 73 02     | .....     | A2       | 8.54      | 4       |                 |
| 62 1671.....  | 18 58.6                           | 62 53     | .....     | A2       | 8.30      | 2       |                 |
| 69 1018.....  | 18 59.5                           | 69 23     | 6.40      | B9       | 6.13      | 10      | S               |
| 70 1039.....  | 19 0.4                            | 70 33     | .....     | Ko       | 8.40      | 5       |                 |
| 73 845.....   | 19 1.0                            | 74 00     | 6.99      | Fo       | 7.17      | 3       |                 |
| 68 1039.....  | 19 1.3                            | 68 34     | .....     | Ao       | 8.41      | 6       |                 |
| 71 923.....   | 19 1.4                            | 71 22     | .....     | Ao       | 8.44      | 7       |                 |
| 62 1674.....  | 19 1.6                            | 62 33     | 7.03      | Ko       | 7.98      | 6       |                 |
| 61 1808.....  | 19 2.4                            | 61 57     | 7.02      | G5       | 7.82      | 5       |                 |
| 68 1040.....  | 19 3.3                            | 68 10     | 6.94      | A2       | 7.18      | 10      | S P.D.M. = 7.26 |
| 65 1319.....  | 19 3.0                            | 65 26     | 7.15      | Ko       | 8.32      | 6       |                 |
| 66 1154.....  | 19 3.7                            | 66 16     | .....     | A3       | 8.32      | 6       |                 |
| 73 848.....   | 19 5.5                            | 73 13     | .....     | Fo       | 7.99      | 4       |                 |
| 61 1817.....  | 19 5.9                            | 61 08     | .....     | F2       | 8.48      | 4       |                 |
| 71 932.....   | 19 8.5                            | 71 55     | 7.00      | F8       | 7.67      | 7       |                 |
| 72 877.....   | 19 9.4                            | 72 06     | .....     | A2       | 7.76      | 7       |                 |
| 65 1326.....  | 19 9.4                            | 65 49     | 6.19      | A2       | 6.27      | 6       | S               |
| 71 934.....   | 19 9.7                            | 71 20     | .....     | Ao       | 8.35      | 5       |                 |
| 68 1046.....  | 19 10.1                           | 68 56     | .....     | K5       | 8.48      | 6       |                 |
| 73 853.....   | 19 10.2                           | 73 28     | .....     | A2       | 8.50      | 4       |                 |
| 62 1691.....  | 19 10.4                           | 63 02     | .....     | F8       | 8.42      | 2       |                 |
| 71 936.....   | 19 11.3                           | 72 04     | 7.40      | Fo       | 7.80      | 7       |                 |
| 69 1034.....  | 19 11.7                           | 69 15     | .....     | A5       | 8.76      | 3       |                 |
| 71 938.....   | 19 11.8                           | 71 56     | .....     | Ao       | 8.25      | 7       |                 |

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| 62° 1608..... | 19 <sup>h</sup> 13 <sup>m</sup> 0 | 62° 37'   | .....        | Ao          | 8.29         | 4       |               |
| 66 1179.....  | 19 13.6                           | 66 56     | 6.81         | A2          | 6.97         | 6       |               |
| 65 1333.....  | 19 14.2                           | 65 06     | 7.40         | Ao          | 7.58         | 6       |               |
| 73 854.....   | 19 14.5                           | 73 43     | .....        | Ma          | 8.70         | 3       |               |
| 65 1335.....  | 19 15.1                           | 65 57     | .....        | F5          | 8.18         | 5       |               |
| 62 1702.....  | 19 15.9                           | 63 02     | 6.91         | F5          | 7.55         | 4       |               |
| 66 1184.....  | 19 16.2                           | 66 58     | .....        | B5          | 7.74         | 7       |               |
| 74 812.....   | 19 16.8                           | 74 51     | .....        | Ko          | 8.35         | 2       |               |
| 60 1926.....  | 19 16.8                           | 60 46     | 7.01         | B9          | 7.03         | 6       | S             |
| 73 856.....   | 19 17.1                           | 73 39     | .....        | Ao          | 8.10         | 4       |               |
| 72 884.....   | 19 17.1                           | 72 45     | .....        | A2          | 8.70         | 4       |               |
| 73 857.....   | 19 17.5                           | 73 10     | 4.63         | Ko          | 5.77         | 4       |               |
| 71 945.....   | 19 18.4                           | 71 10     | 7.06         | G5          | 7.78         | 7       |               |
| 67 1142.....  | 19 18.5                           | 67 28     | .....        | Ao          | 8.37         | 4       |               |
| 64 1344.....  | 19 19.0                           | 64 12     | 6.33         | B9          | 6.28         | 7       | S             |
| 74 815.....   | 19 19.7                           | 74 44     | .....        | Ao          | 8.36         | 2       |               |
| 63 1516.....  | 19 19.9                           | 63 53     | 7.59         | A5          | 8.15         | 6       | S P.D.M.=7.98 |
| 65 1345.....  | 19 20.1                           | 65 31     | 4.63         | A2          | 4.94         | 6       | S P.D.M.=4.80 |
| 74 816.....   | 19 20.3                           | 74 07     | .....        | A2          | 8.21         | 2       |               |
| 73 860.....   | 19 20.8                           | 73 22     | 6.71         | A5          | 7.09         | 8       | S P.D.M.=7.21 |
| 71 949.....   | 19 22.1                           | 71 55     | 7.16         | Ko          | 8.20         | 7       |               |
| 60 1043.....  | 19 22.7                           | 60 09     | 7.76         | Ko          | 8.76         | 4       |               |
| 70 1058.....  | 19 22.8                           | 70 24     | 8.19         | Ao          | 8.22         | 7       |               |
| 60 1044.....  | 19 22.8                           | 61 00     | 7.81         | K2          | 8.85         | 4       |               |
| 68 1062.....  | 19 23.9                           | 68 49     | 7.14         | Ma          | 8.55         | 4       |               |
| 71 951.....   | 19 24.2                           | 71 42     | .....        | A5          | 8.46         | 5       |               |
| 74 821.....   | 19 25.1                           | 74 26     | .....        | B9          | 8.31         | 2       |               |
| 62 1716.....  | 19 25.3                           | 62 21     | 6.46         | K5          | 8.04         | 4       |               |
| 60 1059.....  | 19 28.0                           | 60 28     | 7.51         | K2          | 8.80         | 4       |               |
| 73 863.....   | 19 28.7                           | 73 09     | 7.69         | F2          | 7.81         | 5       |               |
| 67 1156.....  | 19 28.7                           | 67 25     | 7.70         | G5          | 8.37         | 6       |               |
| 72 895.....   | 19 29.2                           | 72 17     | 7.69         | Ko          | 8.49         | 6       |               |
| 60 1063.....  | 19 30.3                           | 60 39     | 8.32         | Go          | 8.73         | 4       |               |
| 71 955.....   | 19 31.0                           | 71 44     | .....        | Ao          | 8.33         | 4       |               |
| 71 956.....   | 19 31.2                           | 72 03     | 7.80         | Ko          | 8.49         | 6       |               |
| 69 1052.....  | 19 31.4                           | 69 19     | .....        | Ko          | 8.47         | 7       |               |
| 70 1073.....  | 19 31.8                           | 70 46     | 6.25         | K2          | 7.65         | 9       |               |
| 61 1877.....  | 19 32.1                           | 61 49     | .....        | Go          | 8.79         | 4       |               |
| 69 1053.....  | 19 32.5                           | 69 30     | 4.78         | Ko          | 5.59         | 10      |               |
| 62 1730.....  | 19 32.6                           | 62 24     | 7.72         | Ko          | 8.74         | 2       |               |
| 71 960.....   | 19 33.2                           | 71 07     | .....        | Ao          | 8.10         | 9       |               |
| 74 828.....   | 19 33.5                           | 74 33     | .....        | A5          | 8.28         | 2       |               |
| 63 1539.....  | 19 33.7                           | 63 13     | 6.64         | K2          | 8.12         | 4       |               |
| 71 964.....   | 19 35.4                           | 71 23     | 6.71         | F2          | 7.01         | 10      |               |
| 60 1981.....  | 19 35.5                           | 60 29     | 8.31         | A5          | 8.84         | 7       |               |

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| 63° 1544..... | 19 <sup>b</sup> 36 <sup>m</sup> 7 | 63° 30'   | .....     | F <sub>2</sub> | 8.51      | 3       |               |
| 66 1225.....  | 19 39.1                           | 66 14     | .....     | A <sub>2</sub> | 8.22      | 6       |               |
| 68 1077.....  | 19 39.2                           | 68 25     | 6.90      | G <sub>5</sub> | 7.82      | 10      |               |
| 62 1747.....  | 19 39.3                           | 62 26     | 7.30      | F <sub>5</sub> | 7.94      | 3       |               |
| 60 1998.....  | 19 40.7                           | 60 19     | .....     | A <sub>2</sub> | 8.44      | 8       |               |
| 60 2005.....  | 19 42.7                           | 60 26     | .....     | A <sub>3</sub> | 8.68      | 8       |               |
| 70 1073.....  | 19 42.9                           | 70 43     | .....     | F <sub>0</sub> | 8.56      | 5       |               |
| 69 1067.....  | 19 43.5                           | 69 15     | .....     | F <sub>0</sub> | 8.36      | 8       |               |
| 71 973.....   | 19 44.0                           | 72 07     | .....     | A <sub>0</sub> | 8.18      | 6       |               |
| 72 909.....   | 19 44.1                           | 72 17     | .....     | A <sub>2</sub> | 8.23      | 5       |               |
| 68 1079.....  | 19 44.4                           | 69 06     | 5.90      | A <sub>0</sub> | 5.91      | 10      | S             |
| 63 1561.....  | 19 44.9                           | 63 16     | 8.04      | F <sub>5</sub> | 8.65      | 3       |               |
| 67 1201.....  | 19 45.8                           | 67 29     | .....     | F <sub>0</sub> | 8.01      | 9       |               |
| 69 1069.....  | 19 46.3                           | 69 40     | .....     | A <sub>0</sub> | 8.20      | 7       |               |
| 68 1082.....  | 19 46.5                           | 68 11     | 6.35      | F <sub>0</sub> | 6.56      | 6       |               |
| 72 911.....   | 19 48.0                           | 72 13     | 7.43      | K <sub>0</sub> | 8.31      | 6       |               |
| 62 1750.....  | 19 48.2                           | 62 57     | 6.83      | K <sub>0</sub> | 8.34      | 5       |               |
| 69 1070.....  | 19 48.5                           | 70 01     | 3.99      | K <sub>0</sub> | 5.04      | 8       |               |
| 65 1406.....  | 19 48.5                           | 65 42     | .....     | F <sub>8</sub> | 8.38      | 2       |               |
| 60 2026.....  | 19 48.8                           | 60 57     | 6.69      | F <sub>5</sub> | 7.17      | 6       |               |
| 60 2027.....  | 19 48.9                           | 60 39     | .....     | A <sub>2</sub> | 8.52      | 5       |               |
| 60 2032.....  | 19 50.3                           | 61 03     | .....     | A <sub>2</sub> | 8.26      | 6       |               |
| 65 1409.....  | 19 50.4                           | 65 17     | 7.85      | G <sub>5</sub> | 8.58      | 2       |               |
| 68 1084.....  | 19 50.5                           | 68 21     | .....     | A <sub>3</sub> | 8.42      | 5       |               |
| 61 1932.....  | 19 50.8                           | 61 43     | .....     | A <sub>2</sub> | 8.64      | 6       |               |
| 66 1253.....  | 19 52.0                           | 66 26     | 7.58      | F <sub>0</sub> | 7.92      | 7       |               |
| 60 2045.....  | 19 53.1                           | 60 33     | 7.34      | K <sub>5</sub> | 8.81      | 5       |               |
| 60 2046.....  | 19 53.2                           | 60 21     | 7.36      | K <sub>5</sub> | 8.90      | 5       |               |
| 64 1398.....  | 19 53.8                           | 64 27     | 6.93      | G <sub>5</sub> | 8.31      | 5       |               |
| 62 1768.....  | 19 53.8                           | 62 20     | 7.97      | F <sub>2</sub> | 8.40      | 2       |               |
| 67 1211.....  | 19 54.2                           | 67 15     | .....     | K <sub>0</sub> | 8.44      | 6       |               |
| 66 1256.....  | 19 54.4                           | 66 29     | 7.24      | K <sub>0</sub> | 8.23      | 6       |               |
| 62 1773.....  | 19 55.9                           | 62 36     | 7.38      | F <sub>0</sub> | 7.96      | 5       |               |
| 60 2059.....  | 19 56.0                           | 60 18     | .....     | A <sub>0</sub> | 8.49      | 6       |               |
| 60 2060.....  | 19 56.3                           | 60 34     | 7.36      | G <sub>5</sub> | 8.44      | 6       |               |
| 63 1584.....  | 19 57.2                           | 63 16     | 5.96      | A <sub>0</sub> | 6.20      | 6       | S P.D.M.=6.37 |
| 71 981.....   | 19 57.7                           | 72 02     | .....     | K <sub>0</sub> | 8.38      | 8       |               |
| 73 890.....   | 19 57.9                           | 73 21     | .....     | F <sub>5</sub> | 8.71      | 7       |               |
| 72 926.....   | 19 57.9                           | 72 40     | .....     | K <sub>5</sub> | 8.36      | 9       |               |
| 71 984.....   | 19 58.4                           | 71 35     | .....     | A              | 8.60      | 5       |               |
| 68 1096.....  | 19 58.4                           | 68 08     | 7.48      | A <sub>2</sub> | 7.78      | 8       | S P.D.M.=7.91 |
| 71 986.....   | 19 58.7                           | 71 39     | .....     | K <sub>0</sub> | 8.52      | 4       |               |
| 60 2070.....  | 19 58.7                           | 60 48     | 8.00      | A <sub>2</sub> | 8.26      | 6       | S P.D.M.=8.53 |
| 69 1084.....  | 19 59.0                           | 70 05     | 6.46      | G <sub>5</sub> | 7.11      | 9       |               |
| 69 1086.....  | 19 59.7                           | 69 08     | .....     | A <sub>0</sub> | 7.54      | 8       |               |

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|---------------|-----------------------------------|-----------|--------------|-------------|--------------|---------|---------------|
| 68° 1007..... | 19 <sup>b</sup> 59 <sup>m</sup> 8 | 68° 10'   | 7.92         | B9          | 7.93         | 8       | S             |
| 74 845.....   | 20 0.0                            | 74 35     | .....        | F2          | 8.69         | 6       |               |
| 64 1405.....  | 20 0.4                            | 64 32     | 5.03         | Ma          | 7.16         | 7       |               |
| 71 901.....   | 20 1.1                            | 71 37     | 7.90         | K5          | 8.61         | 5       |               |
| 64 1407.....  | 20 1.2                            | 64 21     | 6.65         | G5          | 7.24         | 6       |               |
| 70 1102.....  | 20 1.8                            | 70 11     | 8.09         | B9          | 8.08         | 8       |               |
| 67 1222.....  | 20 2.4                            | 67 35     | 4.66         | K3          | 5.90         | 9       |               |
| 63 1503.....  | 20 3.5                            | 63 36     | 6.18         | A2          | 6.28         | 5       |               |
| 61 1970.....  | 20 4.0                            | 61 42     | 5.57         | Ko          | 6.77         | 5       |               |
| 67 1226.....  | 20 4.5                            | 67 44     | 6.56         | Ma          | 8.17         | 8       |               |
| 70 1104.....  | 20 5.1                            | 71 07     | .....        | Ao          | 8.40         | 8       |               |
| 63 1598.....  | 20 5.5                            | 63 25     | 7.32         | Ao          | 7.77         | 5       | S P.D.M.=8.12 |
| 73 866.....   | 20 5.7                            | 74 03     | .....        | F5          | 8.48         | 7       |               |
| 72 933.....   | 20 5.8                            | 72 44     | .....        | G           | 8.60         | 8       |               |
| 72 934.....   | 20 5.8                            | 72 29     | 7.70         | Ao          | 7.47         | 7       | S             |
| 73 897.....   | 20 5.9                            | 73 37     | 6.86         | Ko          | 7.83         | 7       |               |
| 67 1227.....  | 20 6.0                            | 68 00     | .....        | B9          | 8.52         | 5       |               |
| 65 1433.....  | 20 6.2                            | 66 01     | 6.89         | Ao          | 7.09         | 6       | S P.D.M.=7.22 |
| 64 1415.....  | 20 6.4                            | 64 54     | 7.70         | A5          | 7.95         | 4       | S P.D.M.=8.00 |
| 73 898.....   | 20 6.5                            | 73 10     | .....        | Ma          | 8.58         | 4       |               |
| 70 1105.....  | 20 6.7                            | 70 21     | 7.79         | Fo          | 8.11         | 11      |               |
| 64 1417.....  | 20 6.7                            | 64 52     | 7.90         | A5          | 8.23         | 4       |               |
| 61 1975.....  | 20 7.4                            | 61 47     | 6.57         | Ao          | 6.72         | 4       | S P.D.M.=6.92 |
| 59 2185.....  | 20 7.7                            | 60 07     | 7.91         | Fo          | 8.32         | 4       |               |
| 63 1601.....  | 20 7.9                            | 63 46     | .....        | Ao          | 8.47         | 2       |               |
| 68 1110.....  | 20 9.0                            | 68 18     | 7.02         | Ko          | 8.37         | 3       |               |
| 70 1106.....  | 20 9.3                            | 70 28     | 8.19         | Ko          | 8.34         | 10      |               |
| 61 1983.....  | 20 9.9                            | 61 47     | 5.72         | F5          | 6.03         | 5       |               |
| 63 1005.....  | 20 10.2                           | 63 14     | .....        | B9          | 7.82         | 3       |               |
| 67 1235.....  | 20 10.5                           | 67 58     | 6.79         | B3          | 6.88         | 9       |               |
| 73 900.....   | 20 10.8                           | 74 08     | .....        | F5          | 8.57         | 4       |               |
| 60 2099.....  | 20 11.6                           | 20 60     | 6.16         | K2          | 7.47         | 6       |               |
| 72 941.....   | 20 11.9                           | 72 22     | .....        | Ko          | 8.66         | 5       |               |
| 71 1007.....  | 20 12.0                           | 71 41     | .....        | F5          | 8.37         | 10      |               |
| 73 901.....   | 20 13.0                           | 73 41     | .....        | Ao          | 8.28         | 7       |               |
| 64 1427.....  | 20 13.0                           | 64 27     | 7.25         | G5          | 8.26         | 6       |               |
| 70 1111.....  | 20 13.6                           | 70 48     | .....        | Fo          | 8.00         | 12      |               |
| 72 943.....   | 20 14.2                           | 72 34     | 7.11         | Fo          | 7.36         | 9       |               |
| 65 1443.....  | 20 14.7                           | 65 33     | 7.65         | F5          | 8.25         | 6       |               |
| 72 945.....   | 20 15.7                           | 72 18     | 7.34         | Ma          | 8.56         | 7       |               |
| 71 1011.....  | 20 15.8                           | 71 50     | .....        | A2          | 8.48         | 10      |               |
| 66 1281.....  | 20 16.5                           | 66 32     | 6.08         | F8          | 6.47         | 8       |               |
| 60 2109.....  | 20 17.1                           | 60 18     | 7.81         | B8          | 7.84         | 6       |               |
| 72 946.....   | 20 17.9                           | 72 34     | .....        | F5          | 8.60         | 7       |               |
| 61 2000.....  | 20 18.0                           | 61 56     | 5.61         | B9          | 5.57         | 6       | S             |

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| 71° 1014..... | 20 <sup>h</sup> 18 <sup>m</sup> 1 | 71° 27'   | .....     | A3       | 8.41      | 9       |               |
| 70 1115.....  | 20 18.3                           | 70 28     | 7.24      | A5       | 7.42      | 11      | S P.D.M.=7.46 |
| 60 2117.....  | 20 19.1                           | 60 44     | .....     | A2       | 8.41      | 7       |               |
| 68 1121.....  | 20 19.6                           | 68 34     | 5.99      | Mb       | 7.44      | 10      |               |
| 63 1618.....  | 20 19.8                           | 63 40     | 5.92      | K5       | 7.52      | 5       |               |
| 74 858.....   | 20 21.6                           | 74 16     | .....     | Go       | 8.77      | 3       |               |
| 69 1099.....  | 20 21.9                           | 69 11     | .....     | A3       | 7.38      | 10      |               |
| 59 2227.....  | 20 22.9                           | 60 01     | 8.11      | Ao       | 8.19      | 3       |               |
| 72 950.....   | 20 23.1                           | 72 54     | .....     | A5       | 8.44      | 10      |               |
| 72 949.....   | 20 23.2                           | 72 50     | .....     | Fo       | 8.34      | 10      |               |
| 60 2125.....  | 20 23.2                           | 60 59     | .....     | A2       | 8.13      | 6       |               |
| 61 2012.....  | 20 24.1                           | 61 15     | .....     | Go       | 8.58      | 5       |               |
| 68 1126.....  | 20 25.7                           | 69 00     | 7.30      | G5       | 8.16      | 10      |               |
| 74 863.....   | 20 26.3                           | 74 47     | .....     | Ao       | 8.68      | 3       |               |
| 65 1422.....  | 20 26.7                           | 65 25     | 6.62      | A2       | 6.65      | 6       | S             |
| 68 1129.....  | 20 26.8                           | 68 27     | 7.24      | G5       | 8.11      | 8       |               |
| 59 2246.....  | 20 27.3                           | 60 05     | 7.36      | Ao       | 7.67      | 3       |               |
| 72 953.....   | 20 27.4                           | 72 30     | .....     | A2       | 8.64      | 8       |               |
| 61 2020.....  | 20 29.9                           | 62 07     | .....     | Ao       | 7.71      | 2       |               |
| 59 2257.....  | 20 30.0                           | 60 06     | 7.11      | F2       | 7.58      | 3       | Var.?         |
| 72 957.....   | 20 30.4                           | 72 12     | 6.42      | K2       | 7.60      | 11      |               |
| 64 1449.....  | 20 30.9                           | 65 34     | 6.79      | Ko       | 7.84      | 7       |               |
| 61 2028.....  | 20 32.1                           | 60 25     | 6.90      | Ao       | 6.97      | 3       | S             |
| 70 1126.....  | 20 32.2                           | 70 11     | 6.72      | Ao       | 6.45      | 8       |               |
| 74 872.....   | 20 32.8                           | 74 37     | 5.18      | A2p      | 5.16      | 7       | S P.D.M.=5.34 |
| 61 2031.....  | 20 33.2                           | 61 41     | .....     | B9       | 8.64      | 4       |               |
| 61 2032.....  | 20 33.3                           | 62 07     | .....     | Ko       | 8.56      | 4       |               |
| 61 2037.....  | 20 34.6                           | 61 39     | .....     | Ao       | 7.57      | 4       |               |
| 69 1057.....  | 20 34.8                           | 70 02     | 7.69      | Ao       | 7.81      | 7       |               |
| 61 2039.....  | 20 34.9                           | 62 05     | .....     | Fo       | 8.10      | 4       |               |
| 69 1114.....  | 20 35.0                           | 69 20     | 6.89      | G5       | 7.66      | 12      |               |
| 60 2131.....  | 20 35.2                           | 61 00     | 6.93      | F2       | 7.24      | 4       |               |
| 60 2142.....  | 20 35.7                           | 60 24     | 7.06      | Go       | 7.94      | 4       |               |
| 60 2143.....  | 20 35.8                           | 60 45     | .....     | A2       | 8.46      | 4       |               |
| 66 1311.....  | 20 36.1                           | 67 09     | 7.35      | B9       | 7.56      | 9       | S P.D.M.=8.00 |
| 60 2145.....  | 20 36.4                           | 60 33     | .....     | F8       | 8.51      | 4       |               |
| 59 2272.....  | 20 38.2                           | 60 09     | 5.95      | F5       | 6.31      | 4       |               |
| 74 877.....   | 20 39.8                           | 74 54     | .....     | A2       | 8.66      | 5       |               |
| 60 2154.....  | 20 40.5                           | 60 14     | 6.11      | Ao       | 6.13      | 4       | S P.D.M.=6.36 |
| 62 1850.....  | 20 40.6                           | 63 00     | .....     | B8       | 7.56      | 4       |               |
| 62 1852.....  | 20 40.9                           | 62 51     | .....     | Ao       | 7.38      | 5       |               |
| 71 1027.....  | 20 41.1                           | 71 30     | .....     | A2       | 8.55      | 9       |               |
| 74 878.....   | 20 41.4                           | 74 39     | .....     | Ao       | 8.90      | 5       |               |
| 65 1499.....  | 20 41.5                           | 65 58     | 6.92      | B9       | 6.97      | 6       |               |
| 72 962.....   | 20 41.7                           | 72 37     | 7.34      | K2       | 8.44      | 10      | S             |

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|---------------|-----------------------------------|-----------|--------------|----------------|--------------|---------|-----------------|
| 66° 1318..... | 20 <sup>h</sup> 41 <sup>m</sup> 0 | 66° 18'   | 5.57         | A <sub>5</sub> | 5.80         | 6       |                 |
| 61 2050.....  | 20 43.3                           | 61 27     | 3.59         | K <sub>0</sub> | 5.20         | 3       |                 |
| 63 1655.....  | 20 43.5                           | 63 11     | .....        | A <sub>5</sub> | 7.60         | 3       |                 |
| 61 2051.....  | 20 43.6                           | 62 02     | .....        | B <sub>9</sub> | 7.83         | 4       |                 |
| 69 1127.....  | 20 43.9                           | 69 23     | 6.52         | K <sub>0</sub> | 7.51         | 8       |                 |
| 63 1660.....  | 20 45.1                           | 63 37     | .....        | F <sub>0</sub> | 7.92         | 4       |                 |
| 66 1326.....  | 20 45.4                           | 66 54     | .....        | B <sub>9</sub> | 8.32         | 6       |                 |
| 71 1029.....  | 20 45.7                           | 71 24     | .....        | G <sub>0</sub> | 8.92         | 5       |                 |
| 74 886.....   | 20 46.0                           | 74 20     | .....        | G <sub>0</sub> | 8.95         | 8       |                 |
| 69 1129.....  | 20 46.0                           | 69 34     | 7.75         | A <sub>0</sub> | 7.82         | 10      | S               |
| 60 2169.....  | 20 46.8                           | 60 46     | .....        | F <sub>8</sub> | 8.28         | 4       |                 |
| 67 1267.....  | 20 47.3                           | 67 39     | 6.94         | F <sub>0</sub> | 7.24         | 8       |                 |
| 61 2057.....  | 20 47.3                           | 62 09     | .....        | B <sub>8</sub> | 7.84         | 4       |                 |
| 68 1157.....  | 20 47.5                           | 68 46     | .....        | G <sub>0</sub> | 8.34         | 6       |                 |
| 63 1663.....  | 20 47.5                           | 63 40     | 6.38         | B <sub>0</sub> | 6.39         | 5       |                 |
| 61 2059.....  | 20 47.6                           | 61 59     | .....        | A <sub>0</sub> | 8.06         | 4       |                 |
| 69 1130.....  | 20 47.8                           | 69 17     | 7.42         | A <sub>0</sub> | 7.54         | 12      | S               |
| 61 2062.....  | 20 48.3                           | 62 01     | .....        | A <sub>0</sub> | 8.20         | 4       |                 |
| 63 1667.....  | 20 48.6                           | 63 28     | .....        | F <sub>0</sub> | 8.23         | 4       |                 |
| 71 1033.....  | 20 49.2                           | 71 24     | .....        | G <sub>5</sub> | 8.83         | 5       |                 |
| 63 1669.....  | 20 49.8                           | 63 24     | .....        | A <sub>2</sub> | 8.40         | 2       |                 |
| 60 2173.....  | 20 50.6                           | 60 19     | .....        | F <sub>2</sub> | 8.59         | 4       |                 |
| 72 967.....   | 20 51.4                           | 72 34     | 8.02         | F <sub>8</sub> | 8.49         | 8       | P.D.M. = 8.61   |
| 61 2070.....  | 20 51.6                           | 61 23     | 7.18         | F <sub>0</sub> | 7.39         | 4       |                 |
| 72 968.....   | 20 51.9                           | 72 42     | 8.12         | A <sub>2</sub> | 8.26         | 7       | S P.D.M. = 8.55 |
| 74 889.....   | 20 52.4                           | 74 23     | .....        | G <sub>5</sub> | 8.45         | 6       |                 |
| 74 890.....   | 20 52.6                           | 74 16     | 7.39         | A <sub>3</sub> | 7.35         | 6       |                 |
| 69 1136.....  | 20 53.6                           | 69 34     | 7.80         | K <sub>0</sub> | 8.56         | 3       |                 |
| 65 1518.....  | 20 53.9                           | 65 18     | 7.25         | B <sub>9</sub> | 7.26         | 8       |                 |
| 60 2179.....  | 20 54.7                           | 61 10     | .....        | F <sub>5</sub> | 8.31         | 4       |                 |
| 62 1878.....  | 20 55.3                           | 62 27     | .....        | A <sub>0</sub> | 8.02         | 3       |                 |
| 60 2181.....  | 20 55.4                           | 60 57     | .....        | G <sub>5</sub> | 8.26         | 4       |                 |
| 68 1170.....  | 20 56.2                           | 68 40     | 7.07         | K <sub>2</sub> | 8.16         | 7       |                 |
| 61 2078.....  | 20 57.6                           | 61 28     | .....        | A <sub>2</sub> | 8.32         | 3       |                 |
| 71 2037.....  | 20 58.5                           | 71 56     | 8.19         | A <sub>2</sub> | 8.33         | 9       | S P.D.M. = 8.51 |
| 70 1156.....  | 20 58.8                           | 70 34     | 8.04         | A <sub>2</sub> | 8.20         | 10      |                 |
| 74 898.....   | 21 0.1                            | 74 32     | .....        | G <sub>0</sub> | 8.93         | 5       |                 |
| 73 922.....   | 21 0.1                            | 73 53     | 7.99         | K <sub>0</sub> | 8.96         | 5       |                 |
| 67 1283.....  | 21 0.4                            | 67 46     | 7.20         | B <sub>5</sub> | 7.34         | 8       | S P.D.M. = 7.60 |
| 62 1889.....  | 21 2.1                            | 62 59     | 7.26         | A <sub>5</sub> | 7.66         | 5       | S P.D.M. = 7.59 |
| 64 1496.....  | 21 2.6                            | 64 37     | .....        | A <sub>0</sub> | 8.34         | 6       |                 |
| 61 2090.....  | 21 2.6                            | 61 30     | .....        | A <sub>2</sub> | 8.26         | 3       |                 |
| 70 1159.....  | 21 3.2                            | 70 55     | .....        | A <sub>0</sub> | 7.68         | 10      |                 |
| 61 2092.....  | 21 3.3                            | 61 47     | 7.58         | A <sub>0</sub> | 7.60         | 4       |                 |
| 62 1892.....  | 21 3.9                            | 62 31     | 7.06         | K <sub>5</sub> | 8.44         | 4       |                 |

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|---------------|----------------------------------|-----------|--------------|-------------|--------------|---------|---------|
| 70° 1162..... | 21 <sup>h</sup> 4 <sup>m</sup> 0 | 70° 25'   | .....        | Ao          | 8.55         | 6       |         |
| 70 1164.....  | 21 5.8                           | 71 02     | 5.96         | F2          | 6.00         | 10      |         |
| 67 1288.....  | 21 6.3                           | 67 51     | 6.80         | A2          | 6.86         | 8       |         |
| 62 1900.....  | 21 6.8                           | 62 30     | .....        | Ao          | 8.33         | 4       |         |
| 71 1046.....  | 21 7.0                           | 71 16     | .....        | F2          | 8.30         | 8       |         |
| 62 1903.....  | 21 7.3                           | 62 53     | 6.50         | B8          | 6.28         | 4       | S       |
| 65 1552.....  | 21 8.3                           | 65 17     | 7.75         | B9          | 7.73         | 6       | S       |
| 65 2554.....  | 21 8.9                           | 65 45     | 7.25         | Ko          | 8.35         | 3       |         |
| 66 1366.....  | 21 9.2                           | 66 08     | 7.37         | Ko          | 8.37         | 3       |         |
| 74 907.....   | 21 10.1                          | 74 50     | 6.96         | F5          | 7.37         | 4       |         |
| 70 1170.....  | 21 10.3                          | 70 50     | .....        | Ao          | 8.77         | 7       |         |
| 70 1171.....  | 21 10.7                          | 70 25     | 7.59         | A3          | 7.69         | 10      | S       |
| 69 1171.....  | 21 10.7                          | 70 02     | 7.10         | K2          | 8.14         | 7       |         |
| 72 926.....   | 21 11.2                          | 73 39     | .....        | Ao          | 9.17         | 4       |         |
| 63 1708.....  | 21 11.7                          | 64 00     | 6.41         | Go          | 6.92         | 4       |         |
| 71 1054.....  | 21 11.8                          | 72 03     | .....        | F5          | 8.77         | 6       |         |
| 67 1295.....  | 21 11.9                          | 67 44     | 8.28         | Ao          | 8.40         | 3       |         |
| 69 7397.....  | 21 12.6                          | 73 52     | .....        | Ao          | 9.10         | 4       |         |
| 69 1152.....  | 21 12.7                          | 69 37     | 6.80         | Ko          | 7.50         | 10      |         |
| 64 1515.....  | 21 12.7                          | 64 20     | 6.92         | Ko          | 8.01         | 5       |         |
| 65 1565.....  | 21 13.8                          | 65 27     | 8.35         | Fo          | 8.40         | 2       |         |
| 72 980.....   | 21 14.0                          | 72 45     | 7.55         | A2          | 7.66         | 7       |         |
| 72 981.....   | 21 14.1                          | 72 59     | .....        | Ko          | 8.91         | 4       |         |
| 74 911.....   | 21 14.4                          | 74 24     | .....        | F2          | 8.79         | 5       |         |
| 68 1195.....  | 21 14.6                          | 68 29     | .....        | A           | 8.44         | 2       |         |
| 74 912.....   | 21 15.6                          | 74 12     | .....        | F2          | 8.79         | 5       |         |
| 60 2217.....  | 21 16.0                          | 60 45     | 6.80         | Mb          | 8.18         | 4       |         |
| 72 982.....   | 21 16.1                          | 73 05     | .....        | Ao          | 9.02         | 5       |         |
| 70 1176.....  | 21 16.1                          | 71 07     | .....        | A3          | 9.11         | 3       |         |
| 65 1574.....  | 21 17.0                          | 64 34     | 7.60         | Ko          | 8.23         | 3       |         |
| 71 1058.....  | 21 17.1                          | 71 44     | .....        | F5          | 8.91         | 5       |         |
| 64 1527.....  | 21 17.3                          | 64 27     | 5.18         | B3p         | 5.19         | 5       |         |
| 60 2226.....  | 21 17.8                          | 60 42     | .....        | Ao          | 8.16         | 4       |         |
| 60 2224.....  | 21 17.8                          | 60 15     | 6.74         | F5          | 7.10         | 5       |         |
| 64 1528.....  | 21 18.0                          | 64 12     | 8.20         | Ao          | 8.09         | 5       |         |
| 60 2227.....  | 21 18.0                          | 60 21     | 6.24         | Ko          | 7.00         | 5       |         |
| 61 2118.....  | 21 18.2                          | 62 06     | .....        | F8          | 8.21         | 3       |         |
| 68 1206.....  | 21 18.8                          | 60 07     | .....        | A5          | 7.78         | 8       |         |
| 59 2362.....  | 21 19.0                          | 60 09     | 7.61         | F5          | 7.68         | 5       |         |
| 72 984.....   | 21 20.2                          | 72 45     | 7.55         | A2          | 7.66         | 7       | S       |
| 63 1721.....  | 21 20.4                          | 63 48     | .....        | Ko          | 8.52         | 4       |         |
| 71 1062.....  | 21 21.2                          | 71 38     | 7.02         | Ao          | 7.07         | 10      | S       |
| 64 1535.....  | 21 21.2                          | 64 34     | 7.38         | B9          | 7.59         | 7       | S       |
| 64 1536.....  | 21 21.3                          | 64 36     | 7.08         | B9          | 7.13         | 6       | S Var.? |
| 60 2233.....  | 21 21.6                          | 60 23     | 7.61         | B3          | 7.33         | 5       |         |

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|---------------|-----------------------------------|-----------|--------------|-------------|--------------|---------|-----------------|
| 60° 2234..... | 21 <sup>h</sup> 21 <sup>m</sup> 8 | 60° 51'   | .....        | Go          | 8.36         | 5       |                 |
| 61 2131.....  | 21 22.0                           | 61 17     | .....        | Ko          | 8.61         | 4       |                 |
| 68 1206.....  | 21 22.4                           | 69 06     | 7.03         | B8          | 6.76         | 9       | S               |
| 69 1166.....  | 21 23.1                           | 69 34     | 7.71         | Ao          | 7.64         | 8       | S               |
| 64 1546.....  | 21 23.9                           | 64 50     | 8.15         | F8          | 8.39         | 5       |                 |
| 62 1942.....  | 21 24.6                           | 63 09     | 7.52         | Ao          | 7.71         | 4       | S P.D.M. = 7.94 |
| 61 2136.....  | 21 24.8                           | 61 39     | 7.56         | Ko          | 8.34         | 4       |                 |
| 61 2139.....  | 21 25.5                           | 61 40     | 6.89         | Ko          | 7.63         | 4       |                 |
| 66 1404.....  | 21 25.7                           | 66 13     | .....        | F2          | 8.08         | 6       |                 |
| 66 1405.....  | 21 25.8                           | 66 22     | 5.42         | B5          | 5.04         | 4       | S               |
| 60 2254.....  | 21 26.5                           | 61 00     | 7.11         | F5          | 7.35         | 4       |                 |
| 66 1407.....  | 21 27.4                           | 66 37     | 6.90         | A2          | 6.83         | 7       | S               |
| 61 2148.....  | 21 28.0                           | 61 28     | .....        | B9          | 7.66         | 4       |                 |
| 63 1741.....  | 21 28.3                           | 63 52     | 8.10         | A2          | 8.27         | 4       | S               |
| 59 2395.....  | 21 28.3                           | 60 01     | 5.52         | Bo          | 5.36         | 4       |                 |
| 67 1322.....  | 21 28.9                           | 67 51     | 7.06         | B9          | 6.91         | 7       | S               |
| 71 1072.....  | 21 29.2                           | 71 15     | .....        | Ao          | 8.33         | 9       |                 |
| 70 1182.....  | 21 29.5                           | 70 34     | 8.19         | Ao          | 8.12         | 10      |                 |
| 69 1178.....  | 21 30.3                           | 69 12     | .....        | A2          | 8.10         | 9       |                 |
| 64 1564.....  | 21 30.4                           | 65 04     | 8.65         | Ao          | 8.39         | 3       |                 |
| 73 936.....   | 21 30.5                           | 73 13     | .....        | Ao          | 8.46         | 7       |                 |
| 72 992.....   | 21 30.9                           | 72 38     | .....        | A2          | 9.01         | 4       |                 |
| 68 1225.....  | 21 31.0                           | 68 20     | .....        | A2          | 8.23         | 4       |                 |
| 61 2155.....  | 21 31.3                           | 61 21     | .....        | A2          | 7.77         | 3       |                 |
| 66 1412.....  | 21 31.4                           | 66 47     | .....        | F8          | 8.30         | 2       |                 |
| 63 1747.....  | 21 31.7                           | 63 18     | 7.38         | A2          | 7.48         | 4       | S               |
| 63 1748.....  | 21 31.8                           | 63 34     | .....        | Ao          | 7.98         | 4       |                 |
| 65 1602.....  | 21 31.9                           | 65 18     | 7.75         | Ao          | 7.89         | 6       | S P.D.M. = 8.13 |
| 61 2158.....  | 21 31.9                           | 61 51     | .....        | B9          | 8.36         | 3       |                 |
| 72 993.....   | 21 32.4                           | 72 31     | .....        | F2          | 8.41         | 9       |                 |
| 66 1415.....  | 21 32.4                           | 66 17     | 7.01         | Ko          | 8.17         | 5       |                 |
| 65 1602.....  | 21 33.0                           | 65 08     | 7.93         | Ao          | 7.88         | 6       |                 |
| 67 1329.....  | 21 33.6                           | 67 46     | 7.52         | B9          | 6.26         | 7       | S P.D.M. = 6.78 |
| 63 1743.....  | 21 33.7                           | 63 15     | 7.81         | Ao          | 7.99         | 4       | S P.D.M. = 8.09 |
| 61 2166.....  | 21 34.6                           | 61 52     | .....        | Ko          | 7.96         | 4       |                 |
| 60 2271.....  | 21 34.6                           | 60 38     | 8.06         | A2          | 8.08         | 4       | S               |
| 61 2169.....  | 21 35.2                           | 61 38     | 4.87         | B2p         | 4.90         | 4       |                 |
| 60 2276.....  | 21 36.3                           | 61 06     | .....        | Oe5         | 8.28         | 4       |                 |
| 74 926.....   | 21 37.2                           | 74 46     | 7.92         | Ao          | 8.20         | 4       | S P.D.M. = 8.24 |
| 70 1190.....  | 21 37.8                           | 70 51     | 7.14         | F5          | 7.36         | 10      |                 |
| 67 1340.....  | 21 37.9                           | 67 40     | .....        | A2          | 8.20         | 2       |                 |
| 70 1191.....  | 21 38.2                           | 70 59     | .....        | A2          | 8.25         | 9       |                 |
| 67 1343.....  | 21 38.3                           | 67 55     | .....        | Ao          | 8.26         | 4       |                 |
| 70 1192.....  | 21 39.0                           | 70 20     | 7.44         | K5          | 8.22         | 7       |                 |
| 69 1191.....  | 21 39.6                           | 69 14     | .....        | Ao          | 7.83         | 8       |                 |

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| 65° 1634..... | 21 <sup>h</sup> 40 <sup>m</sup> 1 | 65° 54'   | .....     | Ao       | 8.03      | 4       |                 |
| 63 1764.....  | 21 40.1                           | 63 16     | 7.01      | F5       | 7.27      | 4       |                 |
| 61 2185.....  | 21 40.3                           | 61 33     | .....     | Ao       | 8.04      | 5       |                 |
| 70 1193.....  | 21 40.4                           | 70 51     | 4.85      | Ko       | 5.80      | 10      |                 |
| 63 1768.....  | 21 40.5                           | 63 45     | .....     | Fo       | 8.32      | 5       |                 |
| 60 2285.....  | 21 41.4                           | 60 25     | 7.46      | G5       | 8.15      | 5       |                 |
| 71 1082.....  | 21 41.9                           | 71 52     | 5.40      | Ko       | 6.29      | 11      |                 |
| 60 2288.....  | 21 42.6                           | 60 40     | 4.46      | A2p      | 4.84      | 4       | S               |
| 71 1085.....  | 21 42.8                           | 71 35     | .....     | F2       | 8.61      | 7       |                 |
| 61 2194.....  | 21 42.9                           | 61 50     | .....     | B2       | 7.32      | 5       |                 |
| 67 1357.....  | 21 43.3                           | 67 17     | .....     | B9       | 8.13      | 8       |                 |
| 65 1647.....  | 21 43.7                           | 65 28     | .....     | A2       | 8.26      | 3       |                 |
| 71 1087.....  | 21 44.1                           | 71 42     | 7.32      | B9       | 7.53      | 8       | S               |
| 69 1195.....  | 21 44.2                           | 69 52     | .....     | G5       | 8.38      | 4       |                 |
| 60 2294.....  | 21 44.5                           | 60 14     | 5.64      | Ma       | 7.14      | 4       |                 |
| 69 1198.....  | 21 45.2                           | 69 41     | 6.42      | Ao       | 6.31      | 8       | S               |
| 64 1594.....  | 21 45.7                           | 64 42     | 6.98      | Ko       | 8.03      | 6       |                 |
| 60 2300.....  | 21 46.4                           | 60 49     | 6.41      | Ma       | 7.93      | 4       |                 |
| 66 1441.....  | 21 46.8                           | 66 20     | 6.51      | F2       | 6.71      | 6       |                 |
| 60 2303.....  | 21 48.0                           | 61 09     | 7.13      | A2       | 7.35      | 4       | S P.D.M. = 7.93 |
| 63 1779.....  | 21 48.4                           | 63 32     | .....     | B9       | 7.40      | 4       |                 |
| 71 1092.....  | 21 48.7                           | 71 17     | .....     | Go       | 8.45      | 6       |                 |
| 71 1093.....  | 21 48.9                           | 71 31     | .....     | A5       | 8.80      | 3       |                 |
| 64 1599.....  | 21 48.9                           | 64 15     | .....     | Ko       | 8.35      | 4       |                 |
| 61 2209.....  | 21 48.9                           | 61 27     | .....     | B3       | 8.11      | 4       |                 |
| 64 1600.....  | 21 49.2                           | 64 26     | 7.01      | Ko       | 7.81      | 5       |                 |
| 62 1092.....  | 21 49.5                           | 62 38     | .....     | B3       | 7.40      | 4       |                 |
| 62 1094.....  | 21 49.7                           | 62 14     | 6.76      | B1       | 6.77      | 2       |                 |
| 71 1095.....  | 21 50.0                           | 71 25     | .....     | A2       | 8.42      | 4       |                 |
| 59 2430.....  | 21 50.0                           | 60 10     | 8.11      | B5       | 8.07      | 4       |                 |
| 71 1096.....  | 21 50.8                           | 72 01     | 7.16      | B9       | 7.11      | 9       |                 |
| 70 1204.....  | 21 50.8                           | 71 08     | 8.11      | B9       | 8.12      | 10      | S P.D.M. = 8.45 |
| 67 1371.....  | 21 50.9                           | 68 02     | 7.40      | Ao       | 7.36      | 7       | S               |
| 63 1784.....  | 21 51.1                           | 63 16     | .....     | Ao       | 7.66      | 4       |                 |
| 69 1204.....  | 21 51.2                           | 69 14     | 7.36      | A2       | 7.38      | 8       |                 |
| 72 1003.....  | 21 51.6                           | 73 14     | 6.58      | Ao       | 6.70      | 7       |                 |
| 71 1097.....  | 21 51.7                           | 71 31     | 7.01      | B9       | 6.80      | 10      |                 |
| 61 2221.....  | 21 52.1                           | 61 31     | .....     | Ko       | 7.90      | 4       |                 |
| 60 2318.....  | 21 52.3                           | 61 04     | 6.22      | K5       | 7.77      | 4       |                 |
| 67 1375.....  | 21 52.4                           | 67 17     | 7.02      | Fo       | 7.18      | 6       |                 |
| 64 1604.....  | 21 52.4                           | 64 32     | .....     | Ao       | 8.10      | 4       |                 |
| 65 1680.....  | 21 52.7                           | 65 15     | 7.15      | Ao       | 7.11      | 6       |                 |
| 64 1607.....  | 21 52.9                           | 64 51     | 5.85      | B2       | 5.64      | 5       |                 |
| 66 1455.....  | 21 53.1                           | 66 13     | 7.87      | Fo       | 8.05      | 5       |                 |
| 62 2004.....  | 21 53.1                           | 62 47     | 7.12      | F5       | 7.80      | 4       |                 |

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| 62° 2006..... | 21 <sup>h</sup> 53 <sup>m</sup> 4 | 62° 25'   | .....        | B5          | 7.42         | 4       |             |
| 62 2007.....  | 21 53.8                           | 62 09     | 5.35         | Map         | 6.78         | 4       |             |
| 64 1611.....  | 21 54.3                           | 65 09     | 7.60         | B3          | 7.26         | 5       |             |
| 60 2320.....  | 21 54.3                           | 61 49     | 6.90         | B3          | 6.74         | 5       |             |
| 65 1690.....  | 21 54.4                           | 65 33     | 7.48         | G5          | 7.77         | 3       |             |
| 66 1463.....  | 21 55.2                           | 66 39     | .....        | A           | 8.30         | 2       |             |
| 62 2010.....  | 21 56.0                           | 62 13     | 6.16         | Mb          | 7.76         | 4       |             |
| 60 2323.....  | 21 56.0                           | 61 11     | .....        | A3          | 7.27         | 5       |             |
| 62 2012.....  | 21 56.2                           | 62 47     | .....        | B8          | 8.23         | 4       |             |
| 63 1794.....  | 21 56.3                           | 63 31     | .....        | B8          | 8.12         | 4       |             |
| 74 946.....   | 21 56.9                           | 74 31     | 6.64         | K5          | 8.19         | 5       |             |
| 67 1382.....  | 21 57.4                           | 67 30     | 7.92         | F5          | 8.19         | 5       |             |
| 61 2233.....  | 21 57.6                           | 62 00     | 6.48         | Bo          | 6.33         | 4       |             |
| 72 1009.....  | 21 57.8                           | 72 42     | 5.15         | F5          | 5.71         | 8       |             |
| 61 2234.....  | 21 58.3                           | 61 29     | 7.12         | K2          | 8.03         | 5       |             |
| 65 1704.....  | 21 58.4                           | 65 36     | .....        | B8          | 8.02         | 6       |             |
| 60 2329.....  | 21 58.4                           | 61 04     | .....        | B8          | 7.79         | 5       |             |
| 60 2330.....  | 21 59.2                           | 60 37     | .....        | Ao          | 7.66         | 5       |             |
| 65 1708.....  | 21 59.5                           | 65 21     | 8.10         | Ao          | 8.03         | 7       |             |
| 74 947.....   | 21 59.6                           | 74 35     | .....        | Ao          | 8.87         | 3       |             |
| 64 1617.....  | 21 59.6                           | 65 01     | .....        | Ao          | 8.38         | 2       |             |
| 65 1712.....  | 22 0.1                            | 65 35     | 6.76         | B8          | 6.67         | 6       | S           |
| 71 1104.....  | 22 0.7                            | 71 34     | .....        | G5          | 8.69         | 4       |             |
| 67 2028.....  | 22 0.9                            | 62 38     | 5.46         | Mb          | 6.88         | 4       |             |
| 74 951.....   | 22 1.2                            | 74 52     | .....        | G5          | 8.62         | 3       |             |
| 71 1105.....  | 22 1.2                            | 72 12     | .....        | Ko          | 8.90         | 3       |             |
| 73 957.....   | 22 1.5                            | 73 20     | .....        | K2          | 8.47         | 4       |             |
| 60 2334.....  | 22 1.6                            | 60 51     | 7.21         | A2          | 7.15         | 5       | S           |
| 62 2029.....  | 22 2.0                            | 62 18     | 5.39         | K5          | 6.69         | 3       |             |
| 61 2246.....  | 22 2.1                            | 61 48     | 5.17         | Oe5         | 5.03         | 3       |             |
| 62 2032.....  | 22 2.3                            | 63 06     | .....        | G5          | 7.65         | 6       |             |
| 67 1402.....  | 22 4.7                            | 67 49     | 7.48         | F2          | 7.69         | 7       |             |
| 69 1219.....  | 22 4.8                            | 69 44     | .....        | Ao          | 8.30         | 5       |             |
| 71 1107.....  | 22 4.9                            | 71 44     | 7.60         | K2          | 8.37         | 5       |             |
| 63 1807.....  | 22 5.0                            | 63 15     | .....        | B5          | 8.01         | 6       |             |
| 69 1221.....  | 22 5.1                            | 70 12     | 7.00         | Ao          | 7.03         | 6       | S           |
| 71 1109.....  | 22 5.3                            | 71 53     | 7.00         | Ao          | 6.84         | 7       | S           |
| 62 2039.....  | 22 5.4                            | 62 14     | .....        | Ao          | 7.59         | 3       |             |
| 74 952.....   | 22 5.6                            | 74 58     | .....        | Go          | 8.89         | 3       |             |
| 67 1405.....  | 22 5.6                            | 68 02     | .....        | F5          | 8.21         | 8       |             |
| 60 2348.....  | 22 5.6                            | 60 30     | 7.26         | B8          | 7.17         | 3       | S           |
| 72 1016.....  | 22 6.0                            | 71 27     | .....        | K2          | 9.02         | 2       |             |
| 67 1409.....  | 22 6.4                            | 67 14     | .....        | Ao          | 6.79         | 9       |             |
| 69 1226.....  | 22 6.7                            | 69 45     | .....        | F2          | 8.10         | 6       |             |
| 63 1815.....  | 22 6.8                            | 63 38     | 7.07         | A2          | 7.13         | 5       | P.D.M.=7.16 |

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| 63° 1818..... | 22 <sup>h</sup> 7 <sup>m</sup> 4 | 63° 52'   | .....     | Ao       | 7.14      | 5       |               |
| 65 1728.....  | 22 7.5                           | 65 49     | .....     | Ao       | 7.90      | 5       |               |
| 64 1634.....  | 22 7.6                           | 65 01     | 7.55      | Ao       | 7.58      | 6       |               |
| 71 1111.....  | 22 7.9                           | 71 51     | 4.99      | G5       | 5.87      | 7       |               |
| 71 1112.....  | 22 8.3                           | 71 37     | 6.36      | B9       | 6.23      | 8       |               |
| 69 1228.....  | 22 8.4                           | 69 38     | 5.54      | F2       | 5.97      | 5       |               |
| 70 1221.....  | 22* 8.5                          | 70 39     | 7.64      | Go       | 8.02      | 8       |               |
| 60 2358.....  | 22 8.7                           | 60 16     | 5.52      | Ko       | 6.55      | 3       |               |
| 70 1222.....  | 22 8.8                           | 70 28     | 7.84      | A2       | 7.99      | 6       |               |
| 68 1286.....  | 22 8.8                           | 68 22     | .....     | Ao       | 7.86      | 6       |               |
| 69 1229.....  | 22 9.1                           | 69 53     | 8.34      | Fo       | 8.34      | 6       |               |
| 63 1820.....  | 22 9.2                           | 63 13     | .....     | Ao       | 7.83      | 5       |               |
| 62 2048.....  | 22 9.3                           | 62 48     | 6.06      | Ma       | 7.26      | 5       |               |
| 68 1287.....  | 22 10.4                          | 68 29     | 7.32      | Ao       | 7.16      | 6       | S             |
| 72 1022.....  | 22 11.1                          | 72 49     | 6.11      | G5       | 6.92      | 7       |               |
| 69 1232.....  | 22 11.2                          | 69 39     | .....     | Ao       | 8.10      | 6       |               |
| 66 1490.....  | 22 11.3                          | 66 26     | .....     | Ao       | 8.24      | 4       |               |
| 71 1116.....  | 22 11.9                          | 71 58     | .....     | Ko       | 8.60      | 6       |               |
| 63 1823.....  | 22 12.8                          | 63 43     | .....     | Ao       | 8.26      | 5       |               |
| 61 2272.....  | 22 13.1                          | 61 49     | 7.00      | A3       | 7.05      | 3       | S             |
| 62 2056.....  | 22 13.4                          | 63 13     | 7.38      | G5       | 8.27      | 5       |               |
| 65 1746.....  | 22 14.3                          | 65 38     | 7.00      | Ao       | 7.02      | 7       | S             |
| 72 1025.....  | 22 14.4                          | 73 06     | .....     | F2       | 8.55      | 4       |               |
| 69 1237.....  | 22 14.4                          | 69 25     | .....     | Ao       | 8.25      | 6       |               |
| 62 2059.....  | 22 14.9                          | 62 18     | 5.99      | K5       | 7.03      | 4       |               |
| 69 1238.....  | 22 15.1                          | 69 34     | 7.48      | Ko       | 8.32      | 5       |               |
| 68 1295.....  | 22 17.9                          | 68 52     | .....     | F5       | 8.02      | 6       |               |
| 64 1649.....  | 22 17.9                          | 64 49     | 7.95      | A2       | 8.13      | 8       |               |
| 66 1501.....  | 22 18.0                          | 66 28     | 7.26      | A5       | 7.36      | 8       | S             |
| 70 1231.....  | 22 18.3                          | 71 11     | .....     | A2       | 8.25      | 6       |               |
| 62 2070.....  | 22 19.1                          | 62 38     | 6.86      | Ao       | 6.87      | 6       | S             |
| 69 1245.....  | 22 19.2                          | 69 46     | 7.84      | Ao       | 7.93      | 7       |               |
| 68 1298.....  | 22 19.6                          | 69 09     | .....     | A2       | 8.14      | 5       |               |
| 61 2291.....  | 22 19.6                          | 61 55     | 6.01      | Ao       | 6.05      | 3       | S P.D.M.=6.24 |
| 71 1127.....  | 22 20.3                          | 71 40     | .....     | A3       | 8.78      | 5       |               |
| 74 963.....   | 22 21.1                          | 74 30     | .....     | Ko       | 8.83      | 3       |               |
| 60 2393.....  | 22 21.7                          | 60 19     | 7.96      | Ao       | 7.93      | 2       |               |
| 70 1234.....  | 22 21.8                          | 70 48     | 7.52      | A3       | 7.58      | 7       |               |
| 70 1236.....  | 22 22.0                          | 70 32     | 7.44      | A3       | 7.37      | 6       |               |
| 72 1036.....  | 22 23.3                          | 73 06     | .....     | Fo       | 8.33      | 6       |               |
| 70 1240.....  | 22 23.4                          | 70 16     | 5.69      | Ko       | 6.63      | 7       |               |
| 68 1303.....  | 22 23.4                          | 68 32     | .....     | Fo       | 7.26      | 6       |               |
| 61 2297.....  | 22 23.7                          | 61 25     | 6.66      | Ko       | 7.58      | 3       |               |
| 64 1665.....  | 22 23.9                          | 64 57     | .....     | G5       | 7.87      | 6       |               |
| 64 1664.....  | 22 23.9                          | 64 37     | 5.66      | Bo       | 5.81      | 6       |               |

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| 63° 1850..... | 22 <sup>h</sup> 24 <sup>m</sup> 00 <sup>s</sup> | 63° 27'   | .....        | Ao          | 7.28         | 5       |               |
| 62 2084.....  | 22 24.1   | 62 45     | .....        | Ao          | 7.86         | 5       |               |
| 72 1037.....  | 22 24.7   | 73 04     | .....        | Ao          | 7.75         | 7       |               |
| 63 1852.....  | 22 25.0   | 63 34     | 6.38         | Ko          | 7.49         | 5       |               |
| 60 2397.....  | 22 25.2   | 60 57     | 7.47         | Ko          | 8.05         | 2       |               |
| 70 1243.....  | 22 25.3   | 70 18     | 7.74         | Ao          | 7.66         | 7       |               |
| 61 2303.....  | 22 25.6   | 61 15     | .....        | Ao          | 8.19         | 3       |               |
| 64 1672.....  | 22 26.0   | 64 36     | .....        | Bo          | 7.99         | 6       |               |
| 65 1774.....  | 22 26.6   | 65 58     | .....        | B8          | 8.24         | 5       |               |
| 69 1256.....  | 22 26.8   | 69 55     | 7.24         | A2          | 7.34         | 8       | S P.D.M.=7.43 |
| 60 2403.....  | 22 27.0   | 61 07     | .....        | Ao          | 8.19         | 3       |               |
| 69 1257.....  | 22 27.2   | 69 40     | 7.16         | B5          | 6.87         | 8       |               |
| 63 1857.....  | 22 27.9   | 63 18     | 7.40         | G5          | 8.12         | 4       |               |
| 61 2312.....  | 22 29.4   | 61 26     | .....        | Ao          | 8.33         | 3       |               |
| 69 1262.....  | 22 30.1   | 69 24     | 6.02         | A5          | 6.26         | 8       | Var.?         |
| 67 1450.....  | 22 30.1   | 67 59     | 7.61         | A3          | 7.71         | 8       | S             |
| 61 2314.....  | 22 30.3   | 61 16     | 6.51         | A2          | 6.61         | 3       | S             |
| 69 1263.....  | 22 30.4   | 69 51     | 6.26         | Ao          | 6.24         | 8       | S             |
| 65 1782.....  | 22 30.6   | 65 19     | 7.65         | Ko          | 8.23         | 6       |               |
| 64 1682.....  | 22 30.6   | 64 42     | 7.75         | B9          | 7.77         | 7       | S P.D.M.=8.07 |
| 73 982.....   | 22 30.7   | 73 33     | 7.20         | K2          | 8.40         | 5       |               |
| 60 2414.....  | 22 31.4   | 60 18     | 7.06         | F2          | 7.35         | 2       |               |
| 65 1784.....  | 22 31.7   | 65 49     | .....        | F2          | 8.17         | 5       |               |
| 66 1527.....  | 22 31.9   | 67 12     | .....        | Ao          | 8.28         | 8       |               |
| 69 1269.....  | 22 32.8   | 69 44     | 7.25         | Ko          | 8.09         | 7       |               |
| 68 1316.....  | 22 33.1   | 68 33     | .....        | A3          | 8.26         | 7       |               |
| 72 1049.....  | 22 33.3   | 73 07     | 5.22         | Fo          | 5.77         | 7       |               |
| 72 1650.....  | 22 33.6   | 72 22     | 7.46         | F5          | 7.48         | 7       |               |
| 63 1872.....  | 22 34.1   | 63 15     | 7.06         | Ko          | 7.64         | 5       |               |
| 59 1552.....  | 22 34.4   | 60 07     | 8.71         | Ao          | 8.59         | 3       |               |
| 65 1789.....  | 22 34.8   | 65 37     | 7.25         | Ao          | 7.28         | 5       | S             |
| 74 978.....   | 22 35.1   | 74 51     | 6.06         | K5          | 7.63         | 3       |               |
| 62 2102.....  | 22 35.1   | 63 04     | 5.21         | A2          | 5.26         | 3       | S P.D.M.=5.40 |
| 73 985.....   | 22 36.0   | 73 59     | .....        | Ko          | 8.53         | 6       |               |
| 66 1535.....  | 22 36.9   | 66 37     | .....        | A           | 8.58         | 3       |               |
| 61 2328.....  | 22 37.1   | 61 32     | .....        | Ao          | 8.36         | 3       |               |
| 65 1790.....  | 22 37.9   | 65 59     | 7.46         | G5          | 7.84         | 7       |               |
| 72 1055.....  | 22 38.8   | 72 44     | 7.68         | Ao          | 7.55         | 7       | S             |
| 64 1701.....  | 22 38.8   | 64 21     | 7.35         | F8          | 8.18         | 4       |               |
| 64 1702.....  | 22 39.2   | 65 09     | 7.80         | Ao          | 7.61         | 7       | S             |
| 64 1704.....  | 22 39.6   | 64 49     | 6.76         | B2          | 6.62         | 6       |               |
| 61 2336.....  | 22 39.7   | 62 09     | 6.89         | G5          | 7.55         | 3       |               |
| 73 989.....   | 22 40.1   | 73 48     | 7.90         | F2          | 8.19         | 5       |               |
| 66 1539.....  | 22 40.1   | 67 13     | .....        | A2          | 8.32         | 6       |               |
| 60 2430.....  | 22 40.4   | 60 59     | 7.77         | K2          | 8.56         | 2       |               |

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| 63° 1882..... | 22 <sup>h</sup> 40 <sup>m</sup> 5 | 64° 03'   | .....     | G0       | 8.00      | 5       |               |
| 60 2433.....  | 22 41.1                           | 60 18     | 8.11      | B8       | 7.91      | 2       | S             |
| 67 1463.....  | 22 41.7                           | 67 36     | .....     | A2       | 8.26      | 7       |               |
| 59 2568.....  | 22 43.0                           | 60 06     | 8.76      | A2       | 8.64      | 2       |               |
| 64 1717.....  | 22 44.3                           | 64 32     | 6.83      | B3       | 6.91      | 6       | P.D.M. = 6.98 |
| 70 1272.....  | 22 44.4                           | 71 01     | .....     | F0       | 8.37      | 8       |               |
| 62 2115.....  | 22 45.0                           | 62 25     | 6.16      | K0       | 7.23      | 4       |               |
| 60 2441.....  | 22 45.0                           | 60 37     | 8.11      | K0       | 8.46      | 2       |               |
| 73 996.....   | 22 45.6                           | 74 08     | 8.43      | A2       | 8.37      | 4       |               |
| 62 2117.....  | 22 45.6                           | 63 11     | .....     | A3       | 8.22      | 5       |               |
| 65 1813.....  | 22 46.1                           | 66 02     | 6.97      | B9       | 6.86      | 8       |               |
| 71 1165.....  | 22 47.0                           | 71 37     | .....     | A2       | 8.23      | 8       |               |
| 65 1817.....  | 22 47.2                           | 66 12     | 7.30      | K2       | 8.20      | 9       |               |
| 74 988.....   | 22 47.3                           | 74 38     | .....     | A0       | 7.69      | 3       |               |
| 71 1166.....  | 22 47.3                           | 72 04     | .....     | G0       | 8.30      | 8       |               |
| 60 2450.....  | 22 47.4                           | 61 10     | 5.80      | G0       | 6.42      | 2       |               |
| 62 2121.....  | 22 47.7                           | 62 27     | 6.84      | G5       | 7.29      | 4       |               |
| 61 2356.....  | 22 48.6                           | 62 54     | .....     | B3       | 7.80      | 2       |               |
| 60 2453.....  | 22 48.9                           | 60 22     | 7.56      | A0       | 7.80      | 2       |               |
| 65 1826.....  | 22 49.3                           | 66 05     | .....     | A2       | 7.80      | 10      |               |
| 60 2456.....  | 22 50.1                           | 60 19     | 8.56      | A3       | 8.34      | 2       |               |
| 63 1904.....  | 22 50.6                           | 63 35     | .....     | G0       | 8.08      | 4       |               |
| 60 2458.....  | 22 51.1                           | 61 04     | .....     | A5       | 8.31      | 2       |               |
| 73 998.....   | 22 51.3                           | 74 04     | 7.58      | F5       | 7.83      | 7       |               |
| 69 1288.....  | 22 52.0                           | 69 46     | 7.64      | A5       | 7.56      | 9       | S             |
| 67 1481.....  | 22 52.1                           | 68 68     | .....     | G0       | 8.37      | 9       |               |
| 61 2371.....  | 22 52.1                           | 61 54     | 7.06      | K5       | 8.12      | 2       |               |
| 71 1172.....  | 22 52.3                           | 72 04     | .....     | F5       | 8.19      | 9       |               |
| 67 1482.....  | 22 52.4                           | 67 43     | 7.96      | B8       | 7.89      | 9       |               |
| 62 2136.....  | 22 52.6                           | 62 19     | 7.76      | B5       | 7.76      | 2       |               |
| 61 2373.....  | 22 52.9                           | 62 12     | 7.70      | B0       | 7.83      | 2       |               |
| 66 1505.....  | 22 53.2                           | 66 47     | .....     | F5       | 8.45      | 7       |               |
| 61 2374.....  | 22 53.6                           | 61 49     | .....     | A2       | 8.32      | 2       |               |
| 67 1485.....  | 22 54.2                           | 67 52     | .....     | B8       | 8.12      | 10      |               |
| 62 2146.....  | 22 54.6                           | 63 10     | 7.36      | B5       | 7.36      | 4       |               |
| 72 1079.....  | 22 54.7                           | 72 36     | 6.64      | K0       | 7.66      | 7       |               |
| 66 1569.....  | 22 54.7                           | 66 33     | .....     | G0       | 8.31      | 3       |               |
| 62 2147.....  | 22 54.8                           | 62 32     | .....     | B8       | 7.46      | 3       |               |
| 69 1292.....  | 22 55.6                           | 70 13     | 8.54      | A2       | 8.30      | 9       |               |
| 71 1177.....  | 22 56.2                           | 72 11     | .....     | F5       | 8.09      | 9       |               |
| 67 1490.....  | 22 56.2                           | 67 25     | .....     | A0       | 7.66      | 8       |               |
| 61 2384.....  | 22 58.1                           | 61 58     | .....     | A5       | 8.07      | 5       |               |
| 63 1917.....  | 22 58.4                           | 63 40     | 8.16      | G5       | 8.43      | 2       |               |
| 62 2160.....  | 22 58.6                           | 62 48     | 7.00      | K0       | 8.05      | 3       |               |
| 71 1181.....  | 22 58.9                           | 72 12     | .....     | A0       | 7.97      | 9       |               |

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| 63° 1920..... | 22 <sup>h</sup> 59 <sup>m</sup> 0 | 63° 41'   | .....        | Ao          | 8.37         | 2       |                 |
| 62 2161.....  | 22 59.0                           | 63 10     | .....        | B           | 8.24         | 2       |                 |
| 61 2385.....  | 22 59.3                           | 62 06     | .....        | Ao          | 7.86         | 5       |                 |
| 62 2162.....  | 22 59.4                           | 63 01     | .....        | B3          | 8.22         | 3       |                 |
| 60 2473.....  | 22 59.4                           | 60 56     | .....        | Ao          | 7.90         | 6       |                 |
| 66 1575.....  | 22 59.7                           | 66 40     | 5.50         | Ko          | 6.61         | 9       |                 |
| 62 2163.....  | 23 0.0                            | 62 51     | .....        | B5          | 7.66         | 3       |                 |
| 62 2165.....  | 23 0.5                            | 62 42     | 6.78         | Ko          | 7.58         | 3       |                 |
| 69 1303.....  | 23 0.7                            | 70 06     | 8.24         | Go          | 8.18         | 9       |                 |
| 63 1925.....  | 23 0.8                            | 63 33     | 7.60         | Fo          | 7.71         | 4       |                 |
| 67 1498.....  | 23 1.1                            | 67 52     | 7.50         | Go          | 7.93         | 8       |                 |
| 74 1001.....  | 23 1.2                            | 74 59     | .....        | Ao          | 7.81         | 4       |                 |
| 61 2388.....  | 23 1.3                            | 61 50     | .....        | A           | 8.03         | 6       |                 |
| 62 2170.....  | 23 2.1                            | 62 40     | 7.46         | B5          | 7.44         | 2       | S               |
| 60 2479.....  | 23 2.4                            | 60 55     | 6.74         | F5          | 6.95         | 6       |                 |
| 60 2482.....  | 23 3.0                            | 60 18     | 7.61         | A2          | 7.60         | 6       | S               |
| 69 1307.....  | 23 3.7                            | 70 09     | 7.64         | Ko          | 8.25         | 10      |                 |
| 64 1758.....  | 23 3.7                            | 65 05     | 6.83         | A2          | 6.97         | 5       | S               |
| 62 2171.....  | 23 3.7                            | 63 06     | 6.19         | B3          | 6.22         | 2       |                 |
| 63 1931.....  | 23 3.9                            | 63 41     | 6.41         | Ko          | 7.27         | 4       |                 |
| 74 1006.....  | 23 4.7                            | 74 51     | 4.56         | G5          | 5.70         | 4       |                 |
| 62 2174.....  | 23 4.8                            | 62 22     | 7.15         | K2          | 7.95         | 2       |                 |
| 65 1850.....  | 23 5.0                            | 65 32     | 7.90         | A3          | 7.80         | 5       |                 |
| 63 1938.....  | 23 5.0                            | 63 28     | .....        | Ao          | 7.82         | 3       |                 |
| 64 1764.....  | 23 5.2                            | 64 20     | 6.62         | B5          | 6.36         | 5       | S               |
| 60 2491.....  | 23 5.2                            | 61 07     | .....        | A           | 7.77         | 6       |                 |
| 67 1503.....  | 23 5.6                            | 67 54     | .....        | B9          | 8.00         | 8       |                 |
| 66 1587.....  | 23 6.0                            | 66 42     | 6.68         | Ao          | 6.68         | 9       | S               |
| 67 1504.....  | 23 6.1                            | 68 06     | .....        | Ao          | 7.92         | 9       |                 |
| 63 1941.....  | 23 6.3                            | 63 59     | 7.12         | F8          | 7.29         | 2       |                 |
| 63 1940.....  | 23 7.9                            | 64 11     | 7.22         | B5          | 7.00         | 3       | S               |
| 64 1773.....  | 23 8.4                            | 64 16     | 7.27         | Ao          | 7.07         | 5       | S               |
| 62 2109.....  | 23 9.7                            | 62 42     | .....        | Ao          | 8.20         | 2       |                 |
| 61 2405.....  | 23 9.8                            | 61 40     | .....        | A           | 8.13         | 6       |                 |
| 64 1779.....  | 23 10.8                           | 64 53     | 7.10         | F2          | 7.53         | 5       |                 |
| 64 1780.....  | 23 11.0                           | 64 28     | 7.67         | F5          | 7.71         | 5       |                 |
| 73 1023.....  | 23 11.1                           | 73 41     | 5.74         | Ao          | 6.01         | 9       | S P.D.M. = 6.16 |
| 63 1955.....  | 23 11.3                           | 63 34     | 7.52         | Fo          | 7.55         | 3       |                 |
| 70 1311.....  | 23 11.8                           | 70 20.5   | 5.62         | A3          | 5.91         | 10      | S P.D.M. = 5.79 |
| 64 1781.....  | 23 11.8                           | 64 16     | .....        | Ao          | 8.18         | 4       |                 |
| 70 1312.....  | 23 12.2                           | 70 16     | 8.09         | Ao          | 8.17         | 10      |                 |
| 63 1960.....  | 23 12.2                           | 63 34     | 7.52         | Fo          | 7.55         | 3       |                 |
| 61 2413.....  | 23 12.2                           | 61 25     | 6.49         | B8          | 6.38         | 4       | S               |
| 74 1016.....  | 23 13.8                           | 74 45     | 6.44         | A2          | 6.45         | 4       | S               |
| 72 1096.....  | 23 14.3                           | 73 08     | 7.28         | Ko          | 8.31         | 9       |                 |

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| 67° 1514..... | 23 <sup>h</sup> 14 <sup>m</sup> 5 | 67° 34'   | 4.90      | G5       | 5.96      | 10      |               |
| 60 2521.....  | 23 15.6                           | 60 36     | 6.82      | B5       | 6.59      | 7       | S             |
| 64 1787.....  | 23 15.8                           | 64 18     | 7.17      | Fo       | 7.28      | 4       |               |
| 73 1027.....  | 23 15.9                           | 73 23     | .....     | Fo       | 7.70      | 9       |               |
| 63 1974.....  | 23 16.9                           | 64 12     | 7.17      | B9       | 7.12      | 4       | S             |
| 63 1978.....  | 23 17.7                           | 63 58     | 7.92      | Ao       | 7.59      | 3       | S             |
| 70 1315.....  | 23 17.8                           | 70 59     | .....     | F2       | 8.15      | 10      |               |
| 66 1603.....  | 23 18.3                           | 66 31     | .....     | F        | 8.43      | 3       |               |
| 63 1988.....  | 23 20.2                           | 63 18     | 6.76      | Ko       | 7.64      | 3       |               |
| 61 2444.....  | 23 20.4                           | 61 44     | 5.20      | K5       | 6.57      | 7       |               |
| 65 1887.....  | 23 20.6                           | 65 39     | .....     | Fo       | 8.30      | 2       |               |
| 68 1376.....  | 23 21.4                           | 68 24     | 7.02      | Ko       | 7.84      | 8       |               |
| 66 1607.....  | 23 21.4                           | 66 22     | 7.60      | Ao       | 7.43      | 9       | S             |
| 69 1331.....  | 23 22.0                           | 70 08     | 6.74      | A2       | 6.71      | 10      |               |
| 67 1525.....  | 23 22.5                           | 67 19     | .....     | A5       | 8.18      | 7       |               |
| 63 1995.....  | 23 22.5                           | 63 41     | .....     | Ao       | 7.74      | 3       |               |
| 63 1996.....  | 23 22.6                           | 64 04     | .....     | Ao       | 8.08      | 2       |               |
| 64 1810.....  | 23 22.9                           | 65 04     | 7.00      | Ko       | 7.65      | 5       |               |
| 69 1332.....  | 23 23.0                           | 69 49     | 5.63      | A2       | 5.98      | 10      | S             |
| 64 1811.....  | 23 23.6                           | 64 50     | .....     | Ao       | 8.20      | 4       |               |
| 73 1035.....  | 23 23.7                           | 73 34     | 7.17      | Fo       | 7.45      | 9       |               |
| 74 1022.....  | 23 25.0                           | 74 40     | 6.54      | Ao       | 6.67      | 5       | S P.D.M.=6.84 |
| 63 2004.....  | 23 26.0                           | 63 50     | 7.26      | A5       | 7.20      | 2       | S             |
| 63 2006.....  | 23 26.2                           | 63 47     | .....     | A3       | 8.18      | 2       |               |
| 61 2462.....  | 23 26.2                           | 61 45     | .....     | Ao       | 7.25      | 7       |               |
| 64 1819.....  | 23 27.7                           | 65 11     | 6.62      | Fo       | 6.80      | 5       |               |
| 71 1208.....  | 23 28.2                           | 71 27     | 6.64      | A2       | 6.73      | 13      | S P.D.M.=6.92 |
| 64 1825.....  | 23 29.1                           | 64 39     | .....     | A2       | 8.40      | 3       |               |
| 66 1615.....  | 23 29.5                           | 67 65     | .....     | A3       | 8.24      | 5       |               |
| 72 1109.....  | 23 29.8                           | 72 22     | 7.24      | A2       | 7.44      | 11      | S P.D.M.=7.50 |
| 70 1327.....  | 23 30.6                           | 71 05     | 6.13      | Ko       | 7.56      | 11      |               |
| 66 1619.....  | 23 30.6                           | 66 56     | 7.40      | Ko       | 8.18      | 7       |               |
| 66 1621.....  | 23 31.2                           | 66 28     | .....     | A2       | 8.30      | 4       |               |
| 66 1622.....  | 23 31.3                           | 66 19     | .....     | Go       | 8.34      | 4       |               |
| 67 1542.....  | 23 32.0                           | 67 18     | 7.20      | Ao       | 7.11      | 9       | S             |
| 70 1329.....  | 23 33.1                           | 70 32     | .....     | F5       | 8.58      | 7       |               |
| 67 1547.....  | 23 33.2                           | 67 23     | .....     | F5       | 8.27      | 7       |               |
| 69 1342.....  | 23 33.9                           | 70 05     | 8.24      | A3       | 8.18      | 7       |               |
| 61 2490.....  | 23 34.1                           | 61 35     | 6.72      | A2       | 6.87      | 9       | S             |
| 74 1032.....  | 23 34.9                           | 74 44     | .....     | A2       | 6.26      | 6       |               |
| 71 1218.....  | 23 34.9                           | 71 24     | .....     | Ao       | 7.73      | 10      |               |
| 73 1047.....  | 23 35.0                           | 73 27     | 6.08      | G5       | 6.89      | 9       |               |
| 64 1836.....  | 23 35.2                           | 64 16     | 8.00      | Ao       | 8.09      | 4       | S             |
| 66 1030.....  | 23 35.8                           | 67 00     | .....     | F8       | 8.32      | 3       |               |
| 64 1838.....  | 23 36.5                           | 64 34     | 7.76      | Ko       | 8.41      | 3       |               |

## CATALOGUE—Continued

| B.D. No.      | R.A. 1900                         | Dec. 1900 | H.R.<br>Mag. | H.D.<br>Sp. | Ptg.<br>Mag. | No. Pl. | Remarks         |
|---------------|-----------------------------------|-----------|--------------|-------------|--------------|---------|-----------------|
| 67° 1557..... | 23 <sup>h</sup> 37 <sup>m</sup> 2 | 68° 07'   | .....        | Ao          | 7.50         | 6       |                 |
| 60 2609.....  | 23 37.7                           | 61 07     | 6.54         | K2          | 7.51         | 10      |                 |
| 73 1052.....  | 23 37.8                           | 73 34     | .....        | B9          | 7.90         | 9       |                 |
| 68 1391.....  | 23 39.1                           | 68 31     | .....        | F5          | 8.19         | 6       |                 |
| 68 1393.....  | 23 40.3                           | 69 12     | 7.03         | B8          | 6.96         | 9       | S               |
| 63 2051.....  | 23 41.7                           | 63 45     | 7.42         | G5          | 8.32         | 5       |                 |
| 65 1943.....  | 23 41.8                           | 66 13     | 5.94         | B3          | 5.86         | 8       |                 |
| 63 2054.....  | 23 42.6                           | 63 35     | 7.86         | B9          | 7.71         | 5       | S               |
| 70 1334.....  | 23 43.0                           | 70 56     | 7.66         | Ko          | 8.24         | 14      |                 |
| 67 1562.....  | 23 43.1                           | 67 15     | 5.02         | Ao          | 5.27         | 9       | S P.D.M. = 5.26 |
| 65 1946.....  | 23 43.3                           | 65 43     | 8.50         | Ao          | 8.38         | 4       |                 |
| 61 2533.....  | 23 44.0                           | 61 40     | 5.61         | A2p         | 5.76         | 6       | S               |
| 73 1061.....  | 23 44.1                           | 74 10     | .....        | F5          | 8.67         | 7       |                 |
| 68 1402.....  | 23 45.5                           | 68 57     | .....        | F8          | 8.37         | 5       |                 |
| 66 1647.....  | 23 45.5                           | 66 21     | 7.21         | F2          | 7.48         | 9       |                 |
| 63 2064.....  | 23 46.1                           | 63 26     | 6.76         | Ao          | 6.78         | 4       | S               |
| 61 2551.....  | 23 47.4                           | 61 19     | 7.31         | Fo          | 7.61         | 6       |                 |
| 74 1047.....  | 23 47.5                           | 74 59     | 6.55         | K2          | 7.39         | 5       |                 |
| 60 2636.....  | 23 48.9                           | 60 18     | 6.98         | Bo          | 7.30         | 6       |                 |
| 60 2637.....  | 23 49.2                           | 61 03     | 7.56         | Bo          | 7.63         | 6       |                 |
| 64 1875.....  | 23 49.3                           | 65 13     | 8.35         | Ao          | 8.10         | 7       |                 |
| 66 1654.....  | 23 49.4                           | 66 16     | .....        | A5          | 8.36         | 5       |                 |
| 62 2323.....  | 23 49.4                           | 62 38     | .....        | Ao          | 8.52         | 4       |                 |
| 61 2562.....  | 23 49.7                           | 61 17     | 7.16         | Bo          | 7.50         | 6       |                 |
| 73 1063.....  | 23 50.0                           | 73 51     | 6.57         | B9          | 6.56         | 8       | S               |
| 69 1369.....  | 23 50.2                           | 70 11     | 8.94         | A           | 8.94         | 2       |                 |
| 74 1051.....  | 23 50.4                           | 74 19     | 7.84         | Ko          | 8.86         | 7       |                 |
| 69 1370.....  | 23 50.7                           | 70 07     | 8.69         | Ao          | 8.49         | 7       |                 |
| 72 1127.....  | 23 52.4                           | 72 18     | .....        | B5          | 7.57         | 9       |                 |
| 61 2573.....  | 23 52.5                           | 61 27     | 7.46         | Ao          | 7.42         | 8       |                 |
| 73 1067.....  | 23 52.6                           | 73 19     | .....        | F5          | 7.85         | 9       |                 |
| 66 1662.....  | 23 53.0                           | 66 42     | .....        | Ao          | 8.15         | 8       |                 |
| 69 1373.....  | 23 53.2                           | 70 01     | 8.29         | Go          | 8.33         | 6       |                 |
| 68 1414.....  | 23 53.5                           | 68 47     | .....        | Fo          | 8.04         | 9       |                 |
| 66 1667.....  | 23 53.9                           | 66 15     | .....        | F5          | 8.13         | 7       |                 |
| 64 1883.....  | 23 54.1                           | 64 20     | .....        | A3          | 8.21         | 5       |                 |
| 73 1068.....  | 23 54.2                           | 74 15     | 7.92         | A3          | 7.93         | 8       | S               |
| 71 1244.....  | 23 54.9                           | 72 04     | .....        | Ko          | 8.22         | 10      |                 |
| 65 1979.....  | 23 55.2                           | 65 23     | 8.40         | F           | 8.33         | 5       |                 |
| 67 1586.....  | 23 55.3                           | 67 18     | .....        | A3          | 7.80         | 9       |                 |
| 61 2580.....  | 23 55.6                           | 61 37     | 7.05         | Go          | 7.22         | 8       |                 |
| 70 1341.....  | 23 56.2                           | 70 22     | 7.69         | Fo          | 7.73         | 10      |                 |
| 60 2650.....  | 23 56.3                           | 60 17     | 7.36         | B5          | 6.91         | 8       | S               |
| 72 1135.....  | 23 56.5                           | 73 03     | 6.52         | Ao          | 6.71         | 9       | S P.D.M. = 6.75 |
| 71 1246.....  | 23 56.5                           | 71 41     | 7.51         | Ko          | 8.22         | 10      |                 |

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| B.D. No.      | R.A. 1900                         | Dec. 1900 | H.R.<br>Mag. | H.D.<br>Sp. | Ptg.<br>Mag. | No. Pl. | Remarks |
|---------------|-----------------------------------|-----------|--------------|-------------|--------------|---------|---------|
| 60° 2657..... | 23 <sup>h</sup> 56 <sup>m</sup> 5 | 60° 40'   | 5.70         | A5          | 5.75         | 8       | S       |
| 65 1984.....  | 23 56.7                           | 65 45     | 7.45         | Ko          | 7.84         | 6       |         |
| 64 1887.....  | 23 56.7                           | 64 54     | 7.85         | F5          | 7.82         | 7       |         |
| 65 1985.....  | 23 56.9                           | 65 53     | 7.30         | B9          | 7.18         | 6       |         |
| 62 2351.....  | 23 56.9                           | 62 47     | .....        | Ao          | 8.25         | 3       |         |
| 72 1136.....  | 23 58.2                           | 72 37     | 7.52         | A2          | 7.36         | 11      | S       |
| 62 2356.....  | 23 58.3                           | 63 05     | 6.26         | B1          | 6.41         | 3       |         |
| 61 2586.....  | 23 59.1                           | 61 44     | 6.00         | Ao          | 5.88         | 6       |         |
| 69 1379.....  | 23 59.7                           | 70 14     | 8.54         | Ao          | 8.33         | 9       |         |
| 65 1994.....  | 23 59.7                           | 65 17     | 8.25         | Ao          | 8.14         | 8       |         |
| 65 1995.....  | 23 59.8                           | 65 58     | .....        | F5          | 8.41         | 2       |         |
| 64 1894.....  | 23 59.8                           | 64 52     | 7.50         | Ko          | 8.07         | 8       |         |
| 63 2103.....  | 23 59.8                           | 64 13     | .....        | F5          | 8.23         | 5       |         |
| 60 2667.....  | 23 59.9                           | 60 46     | 5.87         | B9          | 5.39         | 5       |         |

# A STUDY OF THE WIDTHS OF THE LINES IN THE B BAND, DUE TO ATMOSPHERIC OXYGEN, IN THE SOLAR SPECTRUM<sup>1</sup>

BY R. VAN DER RIET WOOLLEY

## ABSTRACT

Widths of the lines in the B band in the solar spectrum have been measured. An observational test of the relation between line width and number of atoms forming the line was made by comparing the widths of the lines at different solar zenith distances. The measurements show a *definite departure from Unsöld's formula*, in which the width is proportional to the one-half power of the number of atoms. These observations show that the width is approximately proportional to the three-eighths power.

## INTRODUCTION

At the suggestion of Mr. Babcock the writer has measured the relative widths of lines in the B band in the solar spectrum. This band is formed by absorption of light by oxygen molecules in the earth's atmosphere. The relative widths of 28 lines in the band can be determined with some accuracy. As far as is known, the present observations are the first measures of relative widths in a band spectrum.

It occurred to the writer that the diurnal changes in the widths of the lines in this band afford an excellent opportunity for making an observational test of the relation between the width of an absorption line and the number of atoms concerned in its formation. For these lines, the number of atoms is proportional to the air path, which can be taken to be proportional to the secant of the sun's zenith distance for values of the secant less than 10. When the secant exceeds this limit, the air path is uncertain.

Let  $r$  be the ratio of the intensity of the light at some point inside an absorption line to the intensity of the continuous background just outside the line. The width of the line measured at some definite value of the parameter  $r$  is related to the number of atoms concerned in the formation of the line. In the case of a solar or stellar line the "number of atoms" referred to is the number above a certain optical depth, and in the case of an atmospheric or laboratory absorption

<sup>1</sup> Contributions from the Mount Wilson Observatory, Carnegie Institution of Washington, No. 420.

line it is, of course, the actual number of absorbing atoms. In either case the relation between the width of the line and the number of atoms depends only on the form of the selective absorption coefficient of the line, expressed as a function of the frequency of the light absorbed; and this relation holds for both telluric and solar lines.

Let  $l_\nu$  be the coefficient of line absorption. Any model of the solar atmosphere, such as Eddington's or Milne's, will give an expression for  $r(\nu)$  of the type

$$r(\nu) = f\left(\frac{al_\nu}{k}\right),$$

where  $k$  is the actual coefficient of continuous absorption of the atmosphere and  $a$  is an abundance factor<sup>1</sup>—that is, the number of atoms in the state which absorbs the line above any particular optical depth is proportional to  $a$ .

There will be an inverse relation,

$$\frac{al_\nu}{k} = \phi(r(\nu)).$$

Observations at a definite point  $r(\nu) = r_i$  give us an observed width  $\nu_i - \nu_o$ , for which

$$a = \frac{k\phi(r_i)}{l_{\nu_i}}.$$

The number of atoms is therefore inversely proportional to  $l_{\nu_i}$ , and the relation between the number of atoms and the width  $\nu_i - \nu_o$  depends only on the form of  $l_\nu$ . The relation is even simpler in the case of a Schuster type of scattering in which there is no continuous absorption. In this case

$$r(\nu) = \frac{1}{1 + NMl_\nu},$$

where  $N$  is the actual number of atoms and  $M$  the mass of each. We thus have

$$N = \frac{1}{Ml_{\nu_i}} \left( \frac{1}{r_i} - 1 \right).$$

<sup>1</sup> Cf. Woolley, *Monthly Notices of the Royal Astronomical Society*, 90, 185 n., 1929.

In the case of a truly absorptive atmosphere, where none of the light is scattered and all the energy is converted into heat, we have

$$r(\nu) = e^{-NMl_\nu}$$

and

$$N = \frac{1}{l_{\nu_i} M} \log_e \frac{1}{r}.$$

In every case

$$N \propto (l_{\nu_i})^{-1}.$$

An expression for  $l_\nu$  as a function of  $\nu$  has been given by Unsöld.<sup>1</sup> This is

$$l_\nu = \frac{2\pi e^4 \nu_0^2 f}{3Mm^2c^4(\nu - \nu_0)^2},$$

where  $M$  is the mass of the atom,  $e$  and  $m$  the charge and mass of the electron, and  $f$  the "oscillator strength" of the line under consideration. This formula, of course, breaks down near the central frequency  $\nu = \nu_0$ . From what has been said above it follows that measurements of the width of an atmospheric line afford a direct test of Unsöld's formula, which gives  $(\nu_i - \nu_0)^2$  proportional to the number of atoms in the air path, that is, to  $\sec z$ , where  $z$  is the sun's zenith distance.

Unsöld has tested this formula observationally on some very strong lines (H and K, the D lines, etc.), and the agreement between observation and theory was considered satisfactory. The peculiar strength which weaker members of multiplets appear to exhibit in the solar spectrum<sup>2</sup> has, however, cast some doubt upon the applicability of the formula to weaker lines.

The Doppler effect modifies the form of  $l_\nu$ . For solar lines this influence becomes important in the case of lines whose Rowland number  $\leq 2$ . In the earth's atmosphere the temperature is very much lower, and the Doppler effect is utterly negligible within the range of widths covered by the lines here measured. Similarly, these

<sup>1</sup> *Zeitschrift für Physik*, **44**, 793, 1927.

<sup>2</sup> Minnaert, *Zeitschrift für Astrophysik*, **1**, 192, 1930; Woolley, *Mt. Wilson Contr.*, No. 413; *Astrophysical Journal*, **72**, 256, 1930.

lines are so wide that the finite resolving power of the instrument does not affect measurements of their width.

The possibility remains of a pressure broadening in the earth's atmosphere. This band has been observed in the laboratory with an air path of about 10 meters at atmospheric pressure. Under these circumstances the lines appear very sharp as compared with the same lines in the solar spectrum.<sup>1</sup> It is therefore evident that in the latter case we are dealing with abundance broadening.

TABLE I  
OBSERVATIONS OF WIDTHS IN MILLIANGSTROMS FROM  
 $\lambda 6908$  TO  $\lambda 6920$

| SPECTROGRAM | $\lambda 6908$ |     | $\lambda 6909$ |     | $\lambda 6913$ |     | $\lambda 6914$ |      | $\lambda 6914 Ni$ |      | $\lambda 6918$ |      | $\lambda 6919$ |      | SEC Z |
|-------------|----------------|-----|----------------|-----|----------------|-----|----------------|------|-------------------|------|----------------|------|----------------|------|-------|
|             | 9/10           | 3/4 | 9/10           | 3/4 | 9/10           | 3/4 | 9/10           | 3/4  | 9/10              | 3/4  | 9/10           | 3/4  | 9/10           | 3/4  |       |
| f.....      | 189            | 108 | 187            | 108 | 160            | 082 | 133            | 078  | 135               | 059  | 114            | 064  | 117            | 064  | 1.69  |
| g.....      | 178            | 101 | 187            | 108 | 153            | 076 | 135            | 076  | 124               | 041  | 119            | 062  | 124            | 057  | 1.70  |
| h.....      | 222            | 135 | 232            | 133 | 160            | 107 | 160            | 107  | 142               | 059  | 151            | 080  | 146            | 080  | 2.40  |
| i.....      | 258            | 160 | 258            | 164 | 162            | 089 | 167            | 091  | 124               | .... | 172            | 096  | 178            | 096  | 4.36  |
| j.....      | 285            | 178 | 320            | 205 | 214            | 124 | *              | *    | 142               | .... | 196            | 107  | 214            | 114  | 6.13  |
| k.....      | 320            | 214 | 392            | 222 | 285            | 178 | *              | *    | 160               | 071  | 267            | 152  | *              | *    | 9.80  |
| m.....      | 358            | 232 | 427            | 214 | 267            | 178 | *              | *    | 142               | 080  | 214            | 151  | *              | *    | 9.52  |
| n.....      | 285            | 196 | 338            | 204 | 232            | 160 | *              | *    | 142               | .... | 204            | 128  | *              | *    | 6.81  |
| o.....      | 279            | 178 | 276            | 174 | 196            | 128 | 204            | 137  | 142               | 071  | 160            | .... | 160            | .... | 4.39  |
| p.....      | 268            | 151 | 270            | 160 | 171            | 124 | 187            | 132  | 142               | 071  | 142            | 089  | 139            | 089  | 3.34  |
| q.....      | 204            | 130 | 214            | 133 | 147            | 107 | ....           | .... | 142               | 071  | 124            | .... | 133            | .... | 2.37  |
| r.....      | 169            | 100 | 171            | 066 | 142            | 068 | 142            | 070  | 124               | .... | 124            | .... | 124            | .... | 1.75  |

\* Blended with atmospheric water-vapor lines at low sun.

#### OBSERVATIONS

Twelve good spectrograms were obtained with the 150-foot solar tower in the first order of the 75-foot spectrograph. The plates are Ilford special rapid panchromatic; the developer, Kodak formula D 61. The method of standardization has been described in *Contribution No. 413*.<sup>2</sup>

All the spectrograms were measured in the region  $\lambda\lambda 6908-6920$ , within which occur six lines of the band and a solar nickel line of Rowland intensity 4. The widths in milliangstroms of these seven lines at  $r=9/10$  and at  $r=3/4$  are shown in Table I, which also gives the values of sec z. The reduction of these measures is shown in

<sup>1</sup> I am indebted to Mr. Babcock for this information from his unpublished material.

<sup>2</sup> Woolley, *Astrophysical Journal*, 72, 256, 1930.

Table II. The mean widths are given in the columns headed "Reduced" and "Unreduced." The unreduced values are the means of

TABLE II  
REDUCTION OF MEASUREMENTS FROM  $\lambda 6908$  TO  $\lambda 6920$

| SPECTROGRAM    | MEAN WIDTH |           |           |           | MEAN OF REDUCED<br>AND UNREDUCED |           | LOG $\frac{\text{SEC } z}{\text{SEC } z_f}$ | LOG (MEAN<br>WIDTH) <sup>2</sup> |  |  |
|----------------|------------|-----------|-----------|-----------|----------------------------------|-----------|---|----------------------------------|--|--|
|                | $r = 9/10$ |           | $r = 3/4$ |           |                                  |           |   |                                  |  |  |
|                | Reduced    | Unreduced | Reduced   | Unreduced | $r = 9/10$                       | $r = 3/4$ |   |                                  |  |  |
| <i>f</i> ..... | 100        | 100       | 100       | 100       | 100                              | 100       | 0.000                                       | 0.000                            |  |  |
| <i>g</i> ..... | 108        | 100       | 104       | 96        | 104                              | 100       | .000  | .016                             |  |  |
| <i>h</i> ..... | 114        | 120       | 121       | 127       | 117                              | 124       | .158  | .158                             |  |  |
| <i>i</i> ..... | 140        | 134       | 149       | 137       | 140                              | 143       | .423  | .298                             |  |  |
| <i>j</i> ..... | 154        | 162       | 160       | 160       | 158                              | 164       | .567  | .417                             |  |  |
| <i>k</i> ..... | 165        | 195       | 184       | 218       | 180                              | 201       | .760  | .558                             |  |  |
| <i>m</i> ..... | 184        | 194       | 203       | 213       | 189                              | 208       | .748  | .594                             |  |  |
| <i>n</i> ..... | 158        | 164       | 184       | 194       | 161                              | 189       | .602  | .486                             |  |  |
| <i>o</i> ..... | 132        | 141       | 153       | 161       | 137                              | 157       | .413  | .334                             |  |  |
| <i>p</i> ..... | 121        | 127       | 137       | 144       | 124                              | 140       | .299  | .242                             |  |  |
| <i>q</i> ..... | 102        | 108       | 118       | 124       | 106                              | 121       | .170  | .106                             |  |  |
| <i>r</i> ..... | 108        | 99        | 97        | 89        | 103                              | 93        | 0.017                                       | -0.016                           |  |  |

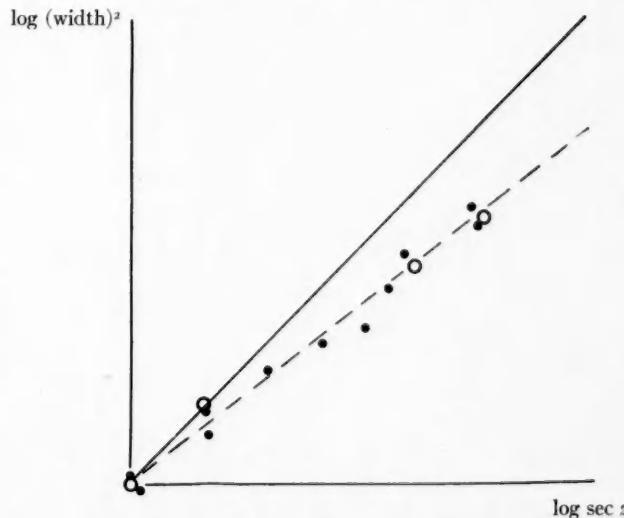


FIG. 1.—Log (mean width)<sup>2</sup> plotted against log sec  $z$ . The unbroken line represents Unsöld's formula.

the ratios of the width of each of the six lines of the band to the width of the corresponding line in spectrum *f*. A certain amount of

systematic error can be eliminated by taking into account variations in the width of the nickel line. If we suppose that all the change in the observed width of this line is due to an error in fixing the position

TABLE III  
OBSERVATIONS OF WIDTHS IN MILLANGSTROMS FROM  
 $\lambda 6872$  TO  $\lambda 6920$

| $\lambda$    | $r$  |       | $k$   |       | $j$   |       | $h$  |     |
|--------------|------|-------|-------|-------|-------|-------|------|-----|
|              | 9/10 | 3/4   | 9/10  | 3/4   | 9/10  | 3/4   | 9/10 | 3/4 |
| 6872.26..... | 178  | 125   | *     | ..... | *     | ..... | 205  | 147 |
| 6872.86..... | 222  | 142   | ..... | ..... | ..... | ..... | 250  | 169 |
| 6873.81..... | 196  | 128   | ..... | ..... | ..... | ..... | 222  | 151 |
| 6874.66..... | 214  | 137   | ..... | ..... | ..... | ..... | 240  | 164 |
| 6875.60..... | 196  | 126   | ..... | ..... | ..... | ..... | 240  | 160 |
| 6876.73..... | 192  | 126   | ..... | ..... | ..... | ..... | 232  | 157 |
| 6877.65..... | 172  | 109   | ..... | ..... | ..... | ..... | 214  | 137 |
| 6879.05..... | 181  | 112   | ..... | ..... | 294   | 189   | 222  | 153 |
| 6879.94..... | 109  | 073   | 276   | 178   | 222   | 139   | 141  | 089 |
| 6883.84..... | 178  | 112   | 330   | 232   | 267   | 187   | 232  | 128 |
| 6885.77..... | 196  | 117   | †     | 250   | 320   | 199   | 222  | 142 |
| 6886.75..... | 232  | 139   | 403   | 317   | 445   | 267   | 262  | 164 |
| 6888.96..... | 201  | 132   | †     | 302   | 356   | 232   | 267  | 162 |
| 6889.91..... | 232  | 146   | 500   | 356   | 428   | 292   | 294  | 178 |
| 6892.38..... | 222  | 141   | †     | 302   | 392   | 250   | 276  | 173 |
| 6893.32..... | 235  | 151   | 535   | 342   | 428   | 285   | 294  | 189 |
| 6896.05..... | 226  | 137   | †     | 302   | 356   | 232   | 267  | 178 |
| 6896.68..... | 232  | 142   | 525   | 338   | 428   | 280   | 285  | 183 |
| 6899.97..... | 205  | 128   | 410   | 276   | 302   | 214   | 250  | 149 |
| 6900.88..... | 222  | 137   | 481   | 312   | 392   | 250   | 285  | 169 |
| 6904.13..... | 192  | 112   | 374   | 249   | 285   | 196   | 221  | 132 |
| 6905.04..... | 205  | 115   | †     | 303   | 356   | 240   | 205  | 137 |
| 6908.55..... | 169  | 100   | 320   | 214   | 285   | 178   | 222  | 135 |
| 6909.45..... | 171  | 105   | 392   | 222   | 320   | 205   | 232  | 133 |
| 6913.21..... | 142  | 066   | 285   | 178   | 214   | 125   | 160  | 107 |
| 6914.10..... | 142  | 068   | †     | †     | †     | †     | 160  | 107 |
| 6918.14..... | 125  | ..... | 267   | 151   | 196   | 107   | 151  | 080 |
| 6919.02..... | 125  | ..... | †     | 151   | 214   | 114   | 146  | 080 |

\* At low sun the lines in the R branch blend together and are not measurable.

† Blended with atmospheric water vapor at low sun.

of the ordinate  $r = 9/10$  on the microphotometer tracing, the corresponding systematic error can be eliminated by multiplying the unreduced mean by the ratio of the observed width of the nickel line in spectrum  $f$  to its observed width in the spectrum under consideration. The results of this correction are the "reduced" means. Since only about one-half of the error in observing the width of the nickel line is systematic, I have used the means of the reduced and unre-

duced values. The values of  $\log(\text{mean width})^2$  are plotted against  $\log \sec z$  as small circles in Figure 1.

Four spectrograms,  $r$ ,  $k$ ,  $j$ ,  $h$ , were then selected on account of the fact that the photographic densities of their continuous backgrounds are approximately equal, a circumstance which tends to eliminate

TABLE IV  
REDUCTION OF MEASUREMENTS FROM  $\lambda 6886$  TO  $\lambda 6920$   
(Width of lines in spectrogram  $r = 100$ )

| $\lambda$              | $k$   |       | $j$   |       | $h$   |       |
|------------------------|-------|-------|-------|-------|-------|-------|
|                        | 9/10  | 3/4   | 9/10  | 3/4   | 9/10  | 3/4   |
| 6885.77                | 184   | 212   | 164   | 170   | 114   | 122   |
| 6886.75                | 200   | 226   | ..... | 192   | 113   | 118   |
| 6888.96                | 204   | 230   | 177   | 176   | 133   | 123   |
| 6889.91                | 215   | 244   | 185   | ..... | 127   | 122   |
| 6892.38                | 192   | 215   | 176   | 177   | 119   | 118   |
| 6893.32                | 226   | 225   | 182   | 188   | 125   | 124   |
| 6896.05                | 182   | 220   | 158   | 169   | 118   | 130   |
| 6896.98                | 227   | 237   | 185   | 196   | 123   | 129   |
| 6899.97                | 200   | 215   | 148   | 169   | 122   | 116   |
| 6900.88                | 216   | 227   | 176   | 182   | 128   | 124   |
| 6904.13                | 194   | 222   | 148   | 174   | 114   | 118   |
| 6905.04                | Blend | 261   | 174   | 208   | 100   | 118   |
| 6908.55                | 189   | 214   | 168   | 178   | 132   | ..... |
| 6909.45                | 230   | 212   | 188   | 195   | 135   | ..... |
| 6913.21                | 200   | 270   | 150   | 189   | 112   | ..... |
| 6914.10                | Blend | ..... | Blend | Blend | 112   | ..... |
| 6918.14                | 214   | ..... | 157   | ..... | 122   | ..... |
| 6919.02                | Blend | Blend | 172   | ..... | 118   | ..... |
| Mean                   | 210   | 223   | 163   | 182   | 120   | 124   |
| $\log(\text{width})^2$ | 216   | ..... | 173   | ..... | 122   | ..... |
| $\log \sec z$          | 0.668 | ..... | 0.470 | ..... | 0.172 | ..... |
|                        | 0.768 | ..... | 0.566 | ..... | 0.158 | ..... |

systematic errors in comparing widths derived from different spectrograms. Measures of these spectrograms from  $\lambda 6872$  to  $\lambda 6920$  are shown in Table III. The widths of the lines for the different values of  $\sec z$  are given in Table IV, expressed in terms of the width of the same line in spectrum  $r$  taken as 100. No correction was made for differences in the width of the nickel line. The values of the  $\log(\text{mean width})^2$  are plotted against  $\log \sec z$  in Figure 1 (large circles). The agreement between the two sets of reductions is highly satisfactory.

These measurements show that the widths of the lines are ap-

proximately proportional to the three-eighths power of the number of atoms in the air path. The deviation from the line given by Unsöld's theory is small but perfectly definite. A larger deviation in

TABLE V  
RELATIVE WIDTHS OF LINES IN THE B BAND AT CONSTANT  $z$

| QUANTUM<br>CLASSIFICATION | $\lambda$ | $r$     |     | $k$  |       | $j$   |       | $h$  |     | MEANS |     | P.E. |     |     |
|---------------------------|-----------|---------|-----|------|-------|-------|-------|------|-----|-------|-----|------|-----|-----|
|                           |           | 9/10    |     | 3/4  |       | 9/10  |       | 9/10 |     | 3/4   |     |      |     |     |
|                           |           | 9/10    | 3/4 | 9/10 | 3/4   | 9/10  | 3/4   | 9/10 | 3/4 | 9/10  | 3/4 |      |     |     |
| R <sub>1</sub>            | 10.....   | 6872.26 | 76  | 82   | Blend | Blend | Blend | 70   | 78  | 73    | 80  | 76   | 3   |     |
|                           | 8.....    | 6873.81 | 84  | 85   | Blend | Blend | Blend | 76   | 80  | 80    | 82  | 81   | 3   |     |
|                           | 6.....    | 6875.60 | 84  | 84   | Blend | Blend | Blend | 82   | 85  | 83    | 85  | 84   | 1   |     |
|                           | 4.....    | 6877.65 | 74  | 72   | Blend | Blend | Blend | 73   | 73  | 73    | 73  | 73   | 2   |     |
|                           | 2.....    | 6879.94 | 46  | 48   | 52    | 52    | 49    | 48   | 47  | 49    | 49  | 49   | 2   |     |
| R <sub>2</sub>            | 8.....    | 6872.86 | 95  | 94   | Blend | Blend | Blend | 91   | 90  | 93    | 92  | 93   | 2   |     |
|                           | 6.....    | 6874.66 | 91  | 91   | Blend | Blend | Blend | 82   | 87  | 87    | 89  | 88   | 3   |     |
|                           | 4.....    | 6876.73 | 82  | 83   | Blend | Blend | Blend | 79   | 83  | 81    | 83  | 82   | 1   |     |
|                           | 2.....    | 6879.95 | 77  | 74   | Blend | Blend | 69    | 67   | 76  | 81    | 74  | 74   | 3   |     |
|                           | 0.....    | 6883.84 | 76  | 74   | 62    | 68    | 63    | 66   | 79  | 68    | 70  | 69   | 5   |     |
| P <sub>1</sub>            | 2.....    | 6885.77 | 83  | 78   | *     | 73    | 75    | 70   | 76  | 76    | 77  | 74   | 76  | 3   |
|                           | 4.....    | 6888.96 | 86  | 87   | *     | 80    | 83    | 82   | 91  | 86    | 87  | 86   | 87  | 2   |
|                           | 6.....    | 6892.38 | 95  | 93   | *     | 89    | 92    | 88   | 94  | 92    | 94  | 91   | 93  | 2   |
|                           | 8.....    | 6896.05 | 96  | 91   | *     | 80    | 83    | 82   | 91  | 94    | 90  | 89   | 90  | 4   |
|                           | 10.....   | 6899.97 | 87  | 85   | 77    | 81    | 71    | 75   | 85  | 79    | 80  | 80   | 80  | 4   |
|                           | 12.....   | 6904.13 | 82  | 74   | 70    | 73    | 67    | 69   | 75  | 70    | 74  | 71   | 73  | 3   |
|                           | 14.....   | 6908.55 | 72  | 66   | 60    | 63    | 67    | 63   | 70  | 72    | 69  | 68   | 68  | 4   |
|                           | 16.....   | 6913.21 | 61  | ...  | *     | 52    | 50    | 44   | 55  | 57    | 55  | 51   | 53  | 4   |
|                           | 18.....   | 6918.14 | 53  | ...  | 50    | 44    | 46    | 38   | 52  | 43    | 50  | 41   | 46  | 4   |
|                           | Mean..... | 6886.75 | 98  | 92   | 87    | 93    | 104   | 94   | 89  | 87    | 94  | 92   | 93  | 4   |
| P <sub>2</sub>            | 2.....    | 6889.91 | 98  | 97   | 93    | 102   | 100   | 103  | 100 | 94    | 99  | 99   | 99  | 3   |
|                           | 4.....    | 6893.32 | 100 | 100  | 100   | 100   | 100   | 100  | 100 | 100   | 100 | 100  | 100 | ... |
|                           | 6.....    | 6896.98 | 98  | 94   | 98    | 99    | 100   | 97   | 97  | 97    | 98  | 97   | 98  | 1   |
|                           | 8.....    | 6900.88 | 95  | 91   | 90    | 92    | 92    | 87   | 97  | 90    | 94  | 90   | 92  | 2   |
|                           | 10.....   | 6905.04 | 87  | 77   | *     | 89    | 83    | 84   | ... | 85    | 83  | 84   | 84  | 3   |
|                           | 12.....   | 6909.45 | 73  | 69   | 73    | 65    | 75    | 73   | 79  | 71    | 75  | 70   | 73  | 2   |
|                           | 14.....   | 6914.10 | 61  | ...  | *     | *     | *     | *    | 57  | 57    | 59  | 57   | 58  | 2   |
|                           | 16.....   | 6919.02 | 53  | ...  | *     | 44    | 50    | 40   | 50  | 43    | 51  | 44   | 48  | 4   |
|                           | Mean..... | 6890.25 | 98  | 92   | 87    | 93    | 104   | 94   | 89  | 87    | 94  | 92   | 93  | 4   |

\* Blended with weak atmospheric water-vapor lines.

the same direction would account for the observed anomalies of the widths of lines in multiplets; as these are, however, considerably narrower than the oxygen lines here measured, a deviation from Unsöld's formula which increases with decreasing line width would account for all the observational facts.

The relative widths of the lines at any instant are of course independent of  $z$ . The widths of the lines, relative to that of the line  $\lambda 6893 = 100$  taken from four spectrograms, are shown in Table V, which is derived from Table III. The classification is that of Babcock and Dieke. The mean relative width and the probable error of this mean are shown in the last two columns. The mean probable error is about 3 per cent of the width of  $\lambda 6893$ .

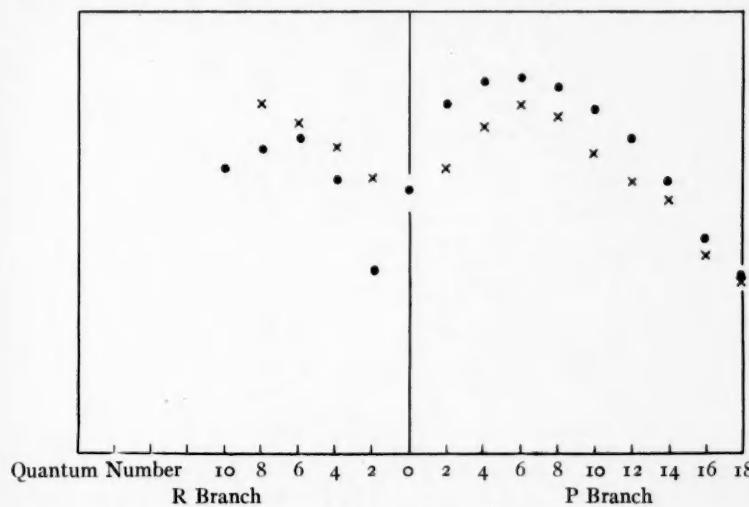


FIG. 2.—Relative widths of the lines in the B band plotted against quantum number. Dots, longer wave-length series  $P_1(j)$  and  $R_1(j)$ . Crosses, shorter wave-length series  $P_2(j)$  and  $R_2(j)$ .

These values are plotted in Figure 2. Unfortunately, as we go toward the violet in the R branch, the lines run together and begin to blend, even with a high sun, at the point where the observations stop, so that we are not able to observe the maximum, which stands out very clearly in the P branch.

My best thanks are due to Miss Ware for preparing the microphotometer tracings. I am indebted to the Commonwealth Fund for the opportunity to work at Mount Wilson.

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MOUNT WILSON OBSERVATORY  
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NOTE ON THE INTERPRETATION OF SPECTRO-  
PHOTOMETRIC OBSERVATIONS OF WEAK  
FRAUNHOFER LINES<sup>1</sup>

BY R. VAN DER RIET WOOLLEY

ABSTRACT

The legitimacy of inferring a number of atoms from observations of line width or of equivalent breadth of a weak Fraunhofer line is discussed with reference to a discordance between some recent observations and the Adams-Russell calibration of Rowland's scale intensities of solar lines. The effect of finite resolving power on the observations is considered, and some calculations of Doppler widening of lines are given. Finally, the theoretical possibilities of a modification of the Adams-Russell calibration, and of a breakdown of Unsöld's method when applied to weak lines, are discussed.

INTRODUCTION

The object of this note is to discuss whether the Adams-Russell calibration of Rowland's scale is affected by recent spectrophotometric observations of Fraunhofer lines which indicate anomalous behavior of the weaker lines in some multiplets.

The Adams-Russell calibration<sup>2</sup> of the Rowland scale depends on the assumption that the numbers of atoms performing the transitions connected with the formation of a multiplet of absorption lines are proportional to the numbers of atoms performing the same transitions when the atom concerned is in thermodynamic equilibrium with radiation. The calibration is independent of any measurements of line width except in so far as these measurements can be interpreted as providing definite information about the relative numbers of atoms performing the transitions.

A method of inferring numbers of atoms from measurements of line width has been developed, principally by A. Unsöld.<sup>3</sup> The application of this method to some recent observations of the equivalent breadth<sup>4</sup> of certain Fraunhofer lines by M. Minnaert and his col-

<sup>1</sup> Contributions from the Mount Wilson Observatory, Carnegie Institution of Washington, No. 421.

<sup>2</sup> Mt. Wilson Contr., No. 358; Astrophysical Journal, **68**, 1, 1928.

<sup>3</sup> Zeitschrift für Physik, **44**, 795, 1927; **46**, 765, 1927; Stewart, Astrophysical Journal, **59**, 30, 1924.

<sup>4</sup> The equivalent breadth of a line is the total amount of light removed from the continuous spectrum by the line. A line has an equivalent breadth of 1 Å if it removes an amount of light equal to that contained in 1 Å of the continuous spectrum in the neighborhood of the line.

laborators<sup>1</sup> and to measures of line widths by the present writer<sup>2</sup> gave the following result: In both cases the ratio of the number of atoms forming the weaker numbers of multiplets to the number forming stronger members is larger than the ratio given by the quantum theory. Ratios derived from the quantum theory, however, have in the main received confirmation from laboratory measurements and are the basis of the Adams-Russell calibration<sup>3</sup> of Rowland's scale.

Further, a direct comparison of the Adams-Russell calibration with a calibration of Rowland's scale based on numbers of atoms deduced from observations of equivalent breadth and width shows a similar discordance. If we can set aside the two possibilities (1) that the observations are vitiated by the finite resolving power of the instruments used, and (2) that the discordance is caused by Doppler broadening of the weaker lines, we are faced with the following alternatives: (3) that the actual relative numbers of atoms in the solar photosphere performing the transitions in multiplets are not equal to the numbers given by the quantum theory and a straightforward application of conditions approximating to thermodynamic equilibrium (in this case the Adams-Russell calibration is incorrect); or (4) that the method developed by Unsöld is not valid for weak lines. In this case abnormal widths cannot be interpreted as due to abnormal numbers of atoms, and the Adams-Russell calibration of Rowland's scale is unaffected by the observations.

We examine these possibilities in detail.

#### I. FINITE RESOLVING POWER

Observations of equivalent breadth should be independent of resolving power. The best check of the effect of finite resolving power on measurements of width seems to be the observational method of determining the width of a line in different orders of a grating. In the writer's observations this was done for lines of Rowland num-

<sup>1</sup> *Zeitschrift für Physik*, **53**, 248, 1929; *Zeitschrift für Astrophysik*, **1**, 192, 1930.

<sup>2</sup> *Mt. Wilson Contr.*, No. 413; *Astrophysical Journal*, **72**, 256, 1930.

<sup>3</sup> It should be mentioned that laboratory measures of multiplet intensities sometimes show serious departures from theoretical relations. The *Ti* multiplet in which the present writer found a discordance between solar and theoretical relative intensity is normal and shows no disagreement between laboratory measurements and theory.

bers 4 and 3. No discordance appeared between measures of various widths, down to 60 milliangstroms, in the third and second orders of the grating.

It does not seem likely that there are large instrumental errors in determinations in the case of lines whose Rowland number is 2 or greater. The agreement between the two deductions made from measurements of line width and of equivalent breadth confirms this view. It is, however, desirable to push instrumental checks still further.

## 2. DOPPLER EFFECT

In a previous paper<sup>1</sup> the writer has given an expression for the modification of the selective absorption coefficient produced by Doppler effect in an assembly of atoms whose velocities have a Maxwellian distribution in velocity corresponding to a temperature  $T$ .

Let  $s_\nu$  be the coefficient of line absorption; in other words, if a monochromatic beam of frequency  $\nu$  traverses unit length in the atmosphere, a fraction  $\rho s_\nu$  of the energy is scattered by the atoms concerned in the formation of the line, where  $\rho$  is the mass per unit volume of the atoms which are in a state suitable for the absorption of this line.

We take the form given by H. Lorentz:<sup>2</sup>

$$s_\nu = \frac{s_0}{1 + a^2(\nu - \nu_0)^2},$$

where  $s_0 (= s_{\nu_0})$  and  $a$  are constants for any particular absorption line.

If  $f$  is the oscillator strength of the line, we have

$$\frac{s_0}{a^2} = \frac{2\pi e^4}{3Mm^2c^4} \nu_0^2 f,$$

$$\frac{s_0}{a} = \frac{e^2}{Mmc} f,$$

whence  $s_0$  and  $a$  can be calculated.

<sup>1</sup> *Monthly Notices of the Royal Astronomical Society*, 90, 170, 1929.

<sup>2</sup> *Proceedings of the Amsterdam Academy*, 18, 134, 1916.

For the scattering coefficient  $s'_\nu$  modified by the Doppler effect we find, after some reduction from a formula given in *loc. cit.*,

$$s'_\nu = \frac{s_0}{a^2(\nu - \nu_0)^2} \sqrt{\frac{4}{\pi}} \int_0^d x^2 e^{-x^2} dx + \frac{s_0 c}{a \nu_0} \left( \frac{\pi M}{2 R T} \right)^{\frac{1}{2}} e^{-d^2},$$

where  $R$  is Boltzmann's constant,  $M$  the mass of the atom concerned, and

$$d = c \left( \frac{\nu - \nu_0}{\nu_0} \right) \sqrt{\frac{M}{2 R T}}.$$

Table I gives values of  $s'_\nu/s_\nu$  calculated for  $T = 6000^\circ$  K,  $\lambda_0 = 4500$  Å, and  $M = 50$  H, where  $H$  is the mass of the hydrogen atom. With this value of  $M$  the calculations can be applied to iron and ti-

TABLE I  
DOPPLER MODIFICATION OF THE SCATTERING COEFFICIENT

| $\lambda - \lambda_0$ in milliangstroms | 45  | 53  | 67   | 78    | 106   |
|---|-----|-----|------|-------|-------|
| $s'_\nu/s_\nu$ . . . . .                | 3.1 | 5.2 | 1.27 | 1.003 | 1.000 |

tanium lines in the sun. This table shows that the Doppler effect begins seriously to modify the widths of lines when  $\lambda - \lambda_0$  becomes less than 70 milliangstroms, that is, in the wings of a line whose Rowland number is 2 or less.

It is of interest to construct theoretical contours of weak lines. This may be done on the basis of Eddington's model, with the equation

$$r(\nu) = \frac{1 + \frac{2}{3}q}{1 + \eta + \frac{2}{3}q},$$

where  $r(\nu)$  = the ratio of the intensity at a point inside the line to the intensity of the continuous background just outside the line. Further,

$$q^2 = 3(1 + \eta)(1 + \epsilon\eta),$$

where  $\epsilon$  is the fraction of the absorbed energy which is converted into heat by superelastic collisions, and

$$\eta = \frac{\alpha s'_\nu}{k},$$

in which  $k$  is the coefficient of continuous absorption and  $a$  the ratio of the mass per unit volume of the atoms in the state by which the line is absorbed to the density of the atmosphere. The values of  $s'_p$  are given in Table II. Taking  $\epsilon = 1/100$ , we compute the following contours for various values of  $k/af$ . Values of  $r$ , calculated for different values of  $\lambda - \lambda_0$ , are given in Table III.

TABLE II  
VALUES OF THE MODIFIED SCATTERING COEFFICIENT  $s'_p$

| $\lambda - \lambda_0$ | 000  | 10        | 20   | 30        | 45   | 53        | 67   | 78        | 106        |
|-----------------------|------|-----------|------|-----------|------|-----------|------|-----------|------------|
| $s'_p$                | 1.82 | $10^{11}$ | 1.10 | $10^{11}$ | 6.75 | $10^{10}$ | 1.82 | $10^{10}$ |            |
| $\lambda - \lambda_0$ | 45   |           | 53   |           | 67   |           | 78   |           |            |
| $s'_p$                | 6.2  | $10^8$    | 7.3  | $10^7$    | 1.1  | $10^7$    | 6.5  | $10^6$    | 3.6 $10^6$ |

The contours are shown in Figure 1. Table IV gives the widths of the lines, that is, the values of  $\lambda - \lambda_0$  for which  $r = 9/10$  and the equivalent breadths of the lines measured from the contours with a planimeter. The values of  $\log N$ , in this case the logarithm of  $af/k$ , and

TABLE III  
CONTOURS OF LINES MODIFIED BY DOPPLER EFFECT

| APPROXIMATE<br>ROWLAND<br>NUMBER | $k$<br>$af$ | $\lambda - \lambda_0$ IN MILLIANGSTROMS |      |      |      |      |      |       |      |      |
|----------------------------------|-------------|---|------|------|------|------|------|-------|------|------|
|                                  |             | 0                                       | 10   | 20   | 30   | 45   | 53   | 67    | 78   | 106  |
| +1.5                             | $10^8$      | 0.10                                    | 0.11 | 0.12 | 0.13 | 0.40 | 0.78 | 0.95  | 0.97 | 0.98 |
| 0                                | $10^9$      | 0.13                                    | 0.14 | 0.17 | 0.20 | 0.80 | 0.97 | 0.995 | 1.00 | 1.00 |
| -2                               | $10^{10}$   | 0.26                                    | 0.32 | 0.38 | 0.62 | 0.98 | 1.00 | 1.00  | 1.00 | 1.00 |
| -3                               | $10^{11}$   | 0.62                                    | 0.71 | 0.79 | 0.91 | 1.00 | 1.00 | 1.00  | 1.00 | 1.00 |

the values of  $\log J_1$  and  $\log J_2$ , which are twice the logarithms of the widths and breadths, respectively, are also given.

These calculations show that the thermal Doppler effect seriously affects the deductions to be made from measurements of lines whose Rowland number is less than 2. Narrow lines are widened relative to stronger lines, an effect similar to the observational result that is the main subject of the present discussion.

It becomes pertinent to ask whether, although the thermal Doppler effect does not affect lines of Rowland number 2-3 or greater,

there may not be an increased Doppler effect due to turbulent motion in the photosphere. Table IV answers this question in the negative. If there were such a turbulent Doppler effect, the lines would decrease in width with decreasing Rowland number even more

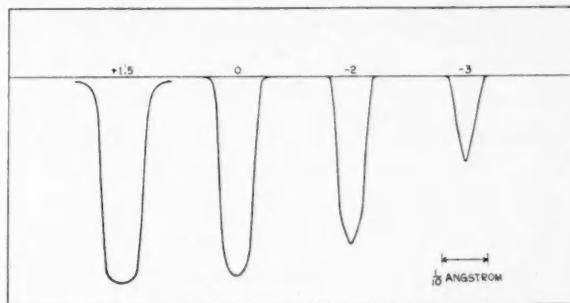


FIG. 1.—Calculated contours of weak lines, showing Doppler modification

slowly than they are observed to do, and there would be a discordance between the values of  $\log J_1$  determined from relative widths and those of  $\log J_2$  determined from equivalent breadth. As it is,

TABLE IV  
WIDTHS AND EQUIVALENT BREADTHS OF LINES MODIFIED  
BY DOPPLER EFFECT

| $k/af$   | $10^8$ | $10^9$ | $10^{10}$ | $10^{11}$ |
|--|--------|--------|-----------|-----------|
| $\lambda - \lambda_0$ (at $r = 9/10$ ) in millangstroms..... | 60     | 50     | 38        | 28        |
| Equivalent breadth in angstroms.....                         | 0.688  | 0.068  | 0.044     | 0.017     |
| $\log N$ .....   | 0      | -1     | -2        | -3        |
| $\log J_1 = \log (\text{width})^2$ .....                     | 0      | -0.16  | -0.40     | -0.66     |
| $\log J_2 = \log (\text{equiv. breadth})^2$ .....            | 0      | -0.22  | -0.60     | -1.43     |

there is general agreement between the two methods for lines of Rowland number greater than 1.

Apparently, therefore, neither finite resolving power nor the Doppler effect can seriously affect deductions from measurements of lines whose Rowland number is greater than 2. Nevertheless there is a sufficient corpus of observations of multiplet and other lines stronger than this limit definitely to establish the existence of the effect under discussion.

### 3. POSSIBILITY OF FAILURE OF ADAMS-RUSSELL CALIBRATION

We should accept the failure of the Adams-Russell calibration only if driven to it by conclusive evidence that none of the other causes is responsible for the observed discordance. On theoretical grounds, however, the possibility of a failure is not wholly excluded. In Eddington's classical paper<sup>1</sup> on the formation of absorption lines, two objections are raised to the assumptions underlying Unsöld's method, one of which, if substantiated, would also affect the basis of the calibration. This objection is Unsöld's neglect of the possibility of interlocking between different lines in a multiplet. Consider a weak line and a strong line in a multiplet which have the same upper state. When the atom absorbs a quantum of energy in either of these lines the electron moves into this upper state, from which it can move into either of the two lower states. There is a definite probability that it will choose to emit the stronger line, and this probability is equal to the ratio of the number of upward transitions connected with absorption of the stronger line to the number of upward transitions connected with absorption of the weaker line when the atom is exposed to a uniform continuous radiation. But if the atom is on top of the photosphere it is exposed to radiation which is deficient in light of the wave-lengths of these two lines, and since the stronger line is the blacker absorption line, it receives proportionately less of the radiation of this frequency, and the ratio of the numbers of upward transitions is disturbed in such a way that these transitions are relatively less frequent in the stronger line. The downward transitions take place in the same ratio as before, this ratio being an atomic constant. There is thus a transfer of radiation from the weaker absorption line to the stronger, and the interlocking effect tends to equalize all the lines corresponding to the same upper state of the atom. This strengthening of the weaker lines is brought about by an alteration of the relative numbers of atoms performing the transitions concerned, and if interlocking is the cause of the observed discordance, we must accept some modification of the Adams-Russell calibration.

<sup>1</sup> *Monthly Notices of the Royal Astronomical Society*, 89, 621, 1929.

The writer has performed some calculations relative to a simple case of interlocking.<sup>1</sup> If these are correct and if they can be generalized in such a way as to apply to complicated multiplet systems, interlocking plays an unimportant part in the formation of absorption lines, as the process is practically restricted to a very thin layer of the photosphere and has a very small effect on the width of a line.

#### 4. POSSIBILITY OF FAILURE OF UNSÖLD'S METHOD

In the same paper Eddington<sup>2</sup> points out that Unsöld's method assumes a certain mechanism as a means of accounting for the behavior of an atom performing selective absorption and re-emission, namely, that when an atom absorbs a quantum in the wings of a line, that is, a quantum of a frequency not exactly equal to the central frequency, it re-emits a quantum of exactly the same frequency as the frequency of absorption. If this postulate which Unsöld has adopted is incorrect, there is a possibility of failure in Unsöld's method.

Let us suppose that when an atom has absorbed a quantum of frequency  $\nu_1$  it does not necessarily re-emit a quantum of exactly the same frequency, but that there is a probability  $p_{12}d\nu$  of re-emission with a frequency in the range  $\nu_2$  to  $\nu_2 + d\nu$ . The mechanism cannot disturb the detailed balancing of the thermodynamic equilibrium between the atom and radiation; therefore, if  $N_1d\nu$  is the number of quanta absorbed from uniform radiation per second by the atom in the range  $\nu_1$  to  $\nu_1 + d\nu$ , and  $N_2d\nu$  is the corresponding number in the range  $\nu_2$  to  $\nu_2 + d\nu$ , we must have  $N_1p_{12} = N_2p_{21}$ . Let us suppose that  $|\nu_2 - \nu_0| > |\nu_1 - \nu_0|$ , where  $\nu_0$  is the central frequency of the line. Then an atom near the top of the photosphere is exposed to radiation which is more deficient in  $\nu_1$  radiation than in  $\nu_2$  radiation, and if  $N'_1$ ,  $N'_2$  refer to the numbers of quanta absorbed per second in the two frequencies by such an atom,

$$N'_2 p_{21} > N'_1 p_{12},$$

and there is a transfer of radiation from the wings to the center of the line and a tendency to broaden the absorption line.

Now if we suppose that the transfer is practically limited to a

<sup>1</sup> *Ibid.*, 90, 779, 1930.

<sup>2</sup> *Loc. cit.*

definite range  $\Delta\nu$ , such as would be the case if, for example,  $p_{12}$  were proportional to

$$\exp \left\{ -\left( \frac{\nu_2 - \nu_1}{\Delta\nu} \right)^2 \right\},$$

the effect on the width of the line would be considerable provided this width were comparable to  $\Delta\nu$ . The broadening due to this atomic redistribution in frequency decreases with increasing abundance-broadening of the line. The effect is somewhat similar to the apparent broadening of a line by an instrument of low resolving power, with the important difference, however, that the light transferred into the central frequency at points below the top of the photosphere will be scattered again, and the total intensity of the line as well as the width will be increased by the redistribution in frequency.

We have here a possible mechanism which broadens weak lines relative to stronger ones and invalidates Unsöld's rule for determining the number of atoms that perform the transitions in the formation of a weak line from measurements of its width or equivalent breadth.

Some observations conducted by the present writer<sup>1</sup> on the diurnal variations in the widths of telluric lines, whose mean Rowland numbers range from 15 to 10, indicate a definite departure from Unsöld's rule, according to which the width of a line is proportional to the square root of the number of atoms concerned in its formation. This departure is in the same direction as the observed discordance between the observations mentioned previously and the Adams-Russell calibration of Rowland's scale, although not of sufficient magnitude to account for all of it. The original observations of Unsöld,<sup>2</sup> which were made on very wide lines, indicated no departure from normal multiplet intensity as tested by his rule. Observations by O. Struve and C. T. Elvey<sup>3</sup> on a wide triplet of *Si* III in stellar spectra indicate no abnormality. Minnaert's observations show a smaller discordance with the Adams-Russell calibration in the range of Rowland numbers 30-10 than in the range 10-1, while that in which the writer found discordance was 4-1.

<sup>1</sup> *Mt. Wilson Contr.*, No. 420; *Astrophysical Journal*, **73**, 185, 1931.

<sup>2</sup> *Loc. cit.*

<sup>3</sup> *Astrophysical Journal*, **72**, 267, 1930.

If  $N$  is the number of atoms deduced for a line from the Adams-Russell calibration or, in the case of a multiplet line, the number given by the quantum theory, and if  $J$  is the number of atoms deduced from applying Unsöld's rule to an observation of the width or the equivalent breadth, then  $\Delta \log J / \Delta \log N$  is a measure of the discordance. Table V shows the observed values of this quantity.

The value given by the writer's observations<sup>1</sup> on telluric lines of Rowland numbers 10-15 is 0.75. For this case  $N$  is the number of atoms in the air path. The observations, if we disregard Minnaert's determination of the equivalent breadths of lines of negative Row-

TABLE V  
DISCORDANCES BETWEEN MEASURED AND THEORETICAL  
NUMBER OF ATOMS

| Authority             | Rowland No.    | $\Delta \log J / \Delta \log N$ |
|-----------------------|----------------|---------------------------------|
| Struve and Elvey..... | 20 and greater | 1.00                            |
| Minnaert.....         | 15-30          | 1.4*                            |
| Minnaert.....         | 20-30          | 1.0                             |
| Minnaert.....         | 1-6            | 0.62                            |
| Woolley.....          | 1-4            | 0.50                            |

\* The value 1.4 depends on the Rowland numbers assigned to the three lines in the  $Mg$  triplet and is therefore not of great weight. The value 1.0 is found by direct comparison of two of these lines with quantum-theory intensities.

land number, which depend on a very small number of lines measured, suggest a progressive deviation from Unsöld's formula that becomes greater as we pass from wider to narrower lines, whether owing to some mechanism, such as redistribution in frequency as suggested by Eddington and quoted above, or to some other cause.<sup>2</sup> If this is the case, the Adams-Russell calibration of the Rowland scale is not affected by the observations. At present it seems more reasonable to interpret the observations quoted above as an indication of a failure of Unsöld's method when applied to weak lines, rather than as a proof of anomalous behavior among multiplet transitions such

<sup>1</sup> *Mt. Wilson Contr.*, No. 420; *Astrophysical Journal*, 73, 185, 1931.

<sup>2</sup> It is somewhat doubtful whether the mechanism of redistribution can account for the behavior of telluric lines. Most of the absorption is performed at pressures so great that collisions are very frequent, and there may be no subsequent re-emission of the light selectively absorbed.

as would invalidate the Adams-Russell calibration of the Rowland scale. The point is of considerable importance, and further work is necessary before a pronouncement can be made definitely in favor of either alternative.

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